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X-RAY DIAGNOSIS OF ACHONDROPLASIA AND CRETINISM.

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It is probably safe to assert that a fair proportion of the members of our profession would, if put to the test, manifest a certain lack of familiarity with the rather uncommon disease achondroplasia. This may be attributed in a large measure to the supposed comparative rarity of the condition. It is quite likely, however, that this disease is not so uncommon as it is generally regarded, and that in many instances it is mistaken for some other condition, especially cretinism or rickets, and largely through this very lack of familiarity perhaps.

An unusual opportunity to study this disease afforded by the examination of three typical cases has led to the personal belief that the diagnosis of achondroplasia is best determined by means of the radiograph. If this be true, it is obvious that every Roentgenologist should be sufficiently familiar with the essential clinical and pathological features of the disease

as to be able to recognize the characteristic radiographic appearances presented. For such a purpose there is surely no other disease concerning which a knowledge of fewer facts is necessary. This statement is based upon the fact that a knowledge of the condition no more extensive than the memory of a simple but comprehensive definition of achondroplasia was sufficient to enable me to identify the radiographic appearances presented by the first case either examined or seen.

This case was referred in March, 1909, by Dr. M. H. Fussell, with a provisional diagnosis of cretinism, likewise a condition in connection with which no previous personal experience could be claimed, from the radiographic standpoint at least. Under the circumstances, therefore, a correct clinical diagnosis could hardly be expected of the radiographer in this instance. Therefore the ease with which a radiographic diagnosis of achondroplasia could be made definitely and unhesitatingly after a careful study of the plates was rendered very apparent at once.

Not only can achondroplasia be diagnosed more readily and with more certainty by the radiograph than by clinical methods, but the radiograph in addition presents certain other characteristic features, otherwise undeterminable during life, besides those appearances which represent the generally recognized typical clinical and pathological features.

The radiographic diagnosis is concerned solely with the examination of the bones of the extremities, and depends upon the unusual appearances presented by characteristic abnormalities in their growth and development. Although practically all of the bones of the extremities show some perceptible alterations, the most characteristic features are presented by those which grow or develop to a large extent from their epiphyseal ends. The diagnosis is therefore easiest during childhood, when ossification in the epiphyses of the humerus, femur, and tibia is normally well advanced. During adult life it is somewhat more difficult for the reason that only the **results** of abnormal development are to be observed. The

FIG. 1—Lower extremities of a case of Achondroplasia. Male, aged fifteen and one-half years.

greatest difficulty is to be encountered during infancy, before ossification in the epiphyseal extremities of these bones is far advanced normally. At any age, however, characteristic appearances will be presented by some bones of the extremities.

The conditions with which achondroplasia are likely to be confused, radiographically as well as clinically, are cretinism and rickets, and the essential points of difference between the skiagraphic appearances of each of the three diseases will be indicated as each of the characteristic radiographic features of achondroplasia is discussed.

Cretinism presents fewer characteristic radiographic features than achondroplasia, and the X-ray diagnosis of the former condition by itself is, therefore, more difficult, but a distinction between the two can be very readily made. Unfortunately the statements that follow concerning cretinism had to be based upon the examination of a single typical case.

Such radiographic features of achondroplasia as are characteristic of the disease and essential in its diagnosis may be conveniently classified under four groups, as follows:

A. Abnormalities in Epiphyseal Growth and Development.

1. A moderate but apparent delay in the beginning of the process of epiphyseal ossification. This is general and is readily determined by comparisons with radiographs of normal individuals of the same age.

This is also a feature of cretinism, and will not therefore serve the purpose of distinguishing between the two conditions.

It is not a noticeable feature of rickets, and if there is any apparent delay, it is not so general as in the other two conditions, and is not manifest very long after the subsidence of the active period of the disease.

2. A moderate retardation in the progress of epiphyseal ossification, which tends later to a slight actual deficiency in development rather than to delayed union.

A similar delay is observed in the cretin, and the deficiency in development is perhaps somewhat more marked. In addition, some delay in epiphyseal union is apparent.

In rickets any retardation would not be nearly as marked unless during the active period, and even then it would not be so general.

3. Deficient and irregular ossification of the epiphyseal ends of the diaphyses is very pronounced, being decidedly apparent during infancy and early childhood, and is especially noticeable in those localities where the growth in length of the shafts takes place largely from the diaphyso-epiphyseal junctions, as at the knee particularly.

This is not a feature of cretinism, but in rickets an appearance somewhat similar is presented. The line of ossification is straighter, however, and has a more ragged and rarefied appearance, due to absorption of bony trabeculae and a coincident failure at calcification, and not to deficient development.

4. Although actually somewhat deficient in development, the epiphyses in children and the fully ossified ends in adults are relatively far better developed than the diaphyses or shafts. This is one of the most characteristic radiographic features of achondroplasia.

In the cretin the appearance is practically the reverse, the epiphyses appearing relatively less well developed if anything than the shafts. This is one of the most important points of distinction between the two diseases radiographically.

In rickets the epiphyseal ends may appear relatively more developed than the shafts **clinically,** but their actual development as indicated **radiographically** by the extent of ossification is not materially greater, and certainly never to the extent which is characteristic of achondroplasia.

5. In all of the long and the short long bones of the extremities a relatively greater degree of development of the diaphyses seems apparent in the immediate neighborhood of the epiphyseal lines, and this is manifest in all of them to a greater or less extent in an **abrupt** expansion at the epiphyseal

FIG. 2—Lower extremities of a case of Cretinism. Female, aged ten years.

ends of the diaphyses, and to a width corresponding to that of the ossified epiphyses.

In cretinism, although the ends of the diaphyses are very much wider than at the middle, there is not the abrupt expansion so characteristic of achondroplasia, but it is gradual as in the normal individual.

The same may be said of rickets.

6. In the case of the metacarpals and metatarsals this peculiar feature gives rise to a very characteristic radiographic appearance in the hands and feet, and one which is not seen in either cretinism or rickets.

7. The same tendency is manifest in the immediate neighborhood of ossification centers of which the growth in general of the shaft is entirely independent, and entirely or nearly so locally, as at the olecranon and lesser trochanter. In the latter instance it is manifest even before epiphyseal ossification begins, and the radiographic appearance presented is characteristic of the condition, and also sufficiently striking to render it an important distinguishing feature between this disease and either cretinism or rickets.

8. The bones of the carpus and tarsus and the patella, while presenting no distinctly characteristic features, exhibit a corresponding delay in ossification or resulting degree of deficiency in development. This is not a distinguishing feature for the reason that a similar, and, if anything, even greater delay and deficiency is manifest in cretinism. In rickets, however, ossification and development of these bones are not similarly affected.

B. Abnormalities in Growth and Development of the Shafts.

1. The shafts of all the long and short long bones of the extremities are not only actually very much shorter than in the normal individual of the same age, but are also relatively short for the size of the achondroplastic's body, and as compared with the other long bones such as the clavicle and ribs.

This can be identified as a deficiency in growth and development from the epiphyseal ends, and is most marked and most apparent in those bones which are the most dependent for their growth in length upon such centers, as the humerus, radius, tibia, and femur especially. These bones may not be found much more than half the length of those of the normal individual of the same age. This is another of the distinctive radiographic features of achondroplasia.

In the cretin, while the shafts are shorter than normal, they are not relatively short for the size of the body or the length of the other long bones, or at least the contrast is by no means so marked as in achondroplasia. Moreover, the shafts do not appear relatively less developed than the epiphyseal extremities or the ends of the bones.

In rickets the shafts of the long bones may be actually shorter than normal, and especially after the active period of the disease has been passed, but as in the cretin they are not relatively short for the body when the apparent shortening due to the usual deformities or bowing is duly considered. Moreover, the shafts do not present the decided lack of development as compared with the ends that is so characteristic of achondroplasia.

2. All of the long and short long bones of the extremities, although actually thinner than normal, are relatively thick for the lengths of their shafts. This is radiographic evidence that periosteal growth is not affected to nearly the same extent in this disease as is epiphyseal development of the shafts.

In the cretin the thickness is nearly or quite in the proper proportion to the length of the shafts. The middle of the shafts, particularly of the tibia and femur, is apt to be found considerably thinner than normal, but toward their ends the diameter gradually increases to a width much nearer the normal. This might be accepted as **radiographic** evidence that deficiency in development from epiphyseal ends is not an essential pathologic feature in cretinism as in achondroplasia.

FIG. 3—Achondroplastic male, aged fourteen months.

In rickets the thickness of the shafts is not to any great extent out of proper proportion to their actual lengths, particularly in the case of the bones of the hands and feet.

3. Many of the long bones appear decidedly bowed. These deformities tend materially to exaggerate the stunted appearance of the extremities for which the shortness of the bones is primarily responsible. At least two factors in the production of the bowing are demonstrable by the radiograph. It is perhaps most marked in the tibia and femur near their adjacent ends, or immediately in the neighborhood of their respective diaphyso-epiphyseal junctions. In these localities the deformities appear to be largely the result of irregularity as well as deficiency in development and ossification. A second but less important or characteristic factor is usually best demonstrable in connection with the bowing of the ulna, which is apparently due to the relatively better development and greater length of this bone than its fellow, the radius, which is more dependent for its growth upon the activity of the region of the lower epiphysis.

In cretinism, in which disturbances in the epiphyseal development of the shafts is not an essential pathologic feature, bowing is not a characteristic appearance.

Rickets presents very similar deformities, but in the case of the tibia and femur the bowing, which is here the result of alterations in the ultimate constituency of the bones and is not developmental, is not so abrupt and distinctly localized to the very limited area as in achondroplasia, but is a more gradual bend involving a greater extent of the shaft. Moreover, the bones of the hands and feet are not so generally or markedly deformed, if at all, as are those of the achondroplastic.

C. Abnormalities in Osseous Structure:

1. A very characteristic appearance of the cancellous structure of the ends or epiphyseal centres of the long bones of the extremities, and of the small bones of the carpus and tarsus, is readily observed in clear radiographs. This peculiar appear-

ance arises from deficiencies or abnormalities in the development of the osseous structure, and is characterized by relatively few walls, and abnormally large spaces correspondingly reduced in number. It is to be observed to best advantage perhaps in the os calcis. The walls as a rule appear to be better developed or are more noticeable in one general direction. The appearance is quite different from that so frequently observed in connection with chronic forms of arthritis and in many other conditions, in which it represents a process of rarefaction or thinning of the walls by absorption with resulting increase in size of the cancellous spaces, but without reduction in their number.

This is distinctly a feature of achondroplasia, and is not characteristic of either cretinism or rickets, and should not be confused with the appearance due to rarefaction in the latter disease.

2. A noticeable but hardly a characteristic feature is the appearance frequently presented by the relatively increased diameter of the medullary canals and their correspondingly thin compact walls in the short thick shafts of the long bones.

D. Other Characteristic but Distinctly Radiographic Features:

1. The radiograph reveals a characteristic tendency for the growth of **exostoses** from the bones of the arm, and particularly from the humerus, with a very striking symmetry in their location on the two sides. Such growths are noticeably absent, however, in the lower extremities. This is distinctly a feature of achondroplasia.

2. Several characteristic features are presented as a result of abnormalities in development of the upper portion of the femur. The neck of the bone is noticeably thin and short and lacking in development at all ages, while the head shows a degree of ossification and development which about corresponds with the epiphyseal extremities or ends of the bones elsewhere. Far more striking in comparison with the unde-

FIG. 4—Right upper extremity of same case as Fig. 1.

FIG. 5—Left upper extremity of same case as Fig. 1.

veloped neck is the relatively superior development of the trochanters, especially the lesser.

In conclusion, the **most strikingly characteristic** radiographic features of achondroplasia may be summarized about in their order of importance as follows:

1. A very decided deficiency in epiphyseal development of the shafts or diaphyses of the long bones of the extremities, making them appear not only very short actually but also relatively in comparison with the size of the body and the lengths of other long bones as the ribs and clavicle. They also appear too thick for their lengths. This deficiency, together with the relatively far better, though not normal, development of the epiphyseal extremities or ends, constitute the most characteristic radiographic feature of the disease.

2. The peculiar characteristic appearance of the hands and feet due to the same abnormalities in development of the short long bones.

3. The abrupt expansion of the diaphyses or shafts in the immediate neighborhood of the diaphyso-epiphyseal junctions.

4. The rather abrupt bowing of the lower end of the femur and upper end of the tibia in these same localities.

5. The characteristic appearance of the upper portion of the femur,—the fairly well developed head, poorly developed, short thin neck, and the far better relative development of the trochanters, the latter being manifest in the adjacent portions of the shaft even before ossification in the epiphyses has begun, especially in the lesser trochanter.

6. The tendency to symmetrical osteomatous growths from the long bones of the upper extremities.

7. The characteristic appearance of the structure of cancellous bone.

8. Deficient and irregular ossification and growth at the epiphyseal ends of the diaphyses, observable during infancy and early childhood, particularly at the knee.

Cretinism presents no distinctly characteristic radiographic features of its own, but it is not likely to be mistaken clinic-

ally for any other conditions than achondroplasia and rickets, from either of which it may be readily distinguished radiographically.

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DISCUSSION.

DR. CHARLES LESTER LEONARD, PHILADELPHIA, PA.

Dr. Pancoast spoke of the difference between cretinism and achondroplasia, but stated that he found no distinctive features in the bones of the cretin. About eight or nine years ago I had an opportunity to study cretinism, before ossification of the epiphyses had taken place. I found in the epiphyses of the head of the tibia and in the lower end of the femur, as well as in the bones of the ankle and foot, separate spots of ossification. There was more density there than in the rest of the bone. I found three rings of ossification in all the small bones of the foot, concentric around the centers of ossification.

It seems to me that this is an important point, one by which we can differentiate early cretinism from the ordinary forms of diseased bones, such as Dr. Pancoast has spoken of. I would like to ask him whether he has seen these concentric rings in the epiphyses, and in the small bones of the foot in the case he studied.

DR. P. M. HICKEY, DETROIT, MICHIGAN.

A point in the radiography of cretins is that often the bone development corresponds very closely with the mental development. A cretin with the mental development of the average child of five usually has bones which, in development, are like those of a child of five, showing, I think, that there must be some relationship between mental and bone development.

DR. JOHN W. HUNTER, JR., NORFOLK, VIRGINIA.

I would like to ask Dr. Pancoast whether he has ever noticed any difference in the radiographs made before and after the administration of thyroidectin in these cases.

FIG. 6—A more recent case of Achondroplasia—a boy aged six years—showing the characteristic radiographic appearance of the hips.

DR. LEWIS GREGORY COLE, NEW YORK.

I have had several cases of cretinism and of osteomalacia, and the greatest difficulty I have had has been in getting the practitioners to agree on the diagnosis. One man will say it is a case of cretinism, another will call it a form of osteomalacia, and a third will claim that it is some other obscure bone lesion, so that I have had some trouble in checking up the findings. I would like to ask Dr. Pancoast whether the physicians who saw these cases in consultation with him agreed with him and with each other in the diagnosis. Also, I would like to know if he had a sufficient number of these cases in which the diagnosis was positive, and how many of these cases he has had.

DR. PANCOAST (closing the discussion).

Replying to the question of Dr. Leonard, with reference to the rings of ossification, I have not observed this. The only cretin I examined was ten years old, and I did not make much of an examination of any part of the body except the long bones, so as to get the general appearance of the hands and feet, because these were the things which, to my mind, were essential to the differential diagnosis.

I said that cretinism did not show any distinctly characteristic X-ray pictures, but I did not mean to say that the diagnosis could not be made with the X-ray; merely that it was difficult to do so as compared with achondroplasia, where the diagnosis can be made with ease.

As to Dr. Hickey's point, concerning the relationship between the mental development and the bone development, I cannot say that that was true in the patient I examined. The patient was ten years old and there had been no change in the mental development for years. I think that there is to be found a decidedly apparent delay in the ossification of the epiphyses. It was the only case of cretinism that I studied, and I had no opportunity to note the condition before and after treatment.

In every one of these cases the physicians were ready to accept the radiographic evidence and findings, and I think that they agreed in all details with the pathologic and clinical features. Of course, there were a few additional radiographic features which can be shown only in this way during life; for instance, the appearance of the hips, the exostoses, and the development of the trochanters.

THE TREATMENT OF ORDINARY AND EXOPHTHALMIC GOITRE WITH SPECIAL REFERENCE TO THE ROENTGEN METHOD.*

BY CARL BECK, M. D.,

Professor of Surgery in the New York Postgraduate Medical School and Hospital, Visiting Surgeon to the St. Mark's Hospital, and the German Poliklinik.

1. A strict line of distinction has to be drawn between common goitre (struma) and exophthalmic goitre (Basedow's, or Graves' Disease), common goitre representing a simple enlargement, while the exophthalmic type is characterized by the production of a special toxine by the thyroid gland.

2. Common goitre, in other words, means either diffuse or partial hypertrophy of the glandular tissue. The contents of the follicles increase and the blood vessels become dilated and multiply. An increase of connective tissue is but rarely observed. The structures may be adenoid, colloid, vascular and adenomatous, the latter form to be subdivided into parenchymatous, fibrous, fibrocalcareous, osteofibrous and vascular varieties. The nature of the tissue change explains why the Roentgen method will only exceptionally be successful. It should, therefore, in order to avoid discrediting the Roentgen treatment, only exceptionally be tried in ordinary goitre.

The disturbances caused by ordinary goitre are of a mechanical character, pressure by a large goitre, for instance, producing lateral curvature of the trachea, followed by symptoms of suffocation. Then speedy strumectomy is imperatively necessary. In small goitres cosmetic considerations may indicate removal, although the condition of the patient be normal otherwise. In cystic goitre I have with rare exceptions succeeded by aspirating the cystic fluid (generally consisting of bloody serum) and injecting one-half ounce of a 10% emulsion of iodoform-glycerine in adults. The area of aspiration must

*Read by title at the meeting of the American Roentgen Ray Society, September 23d, 1909.

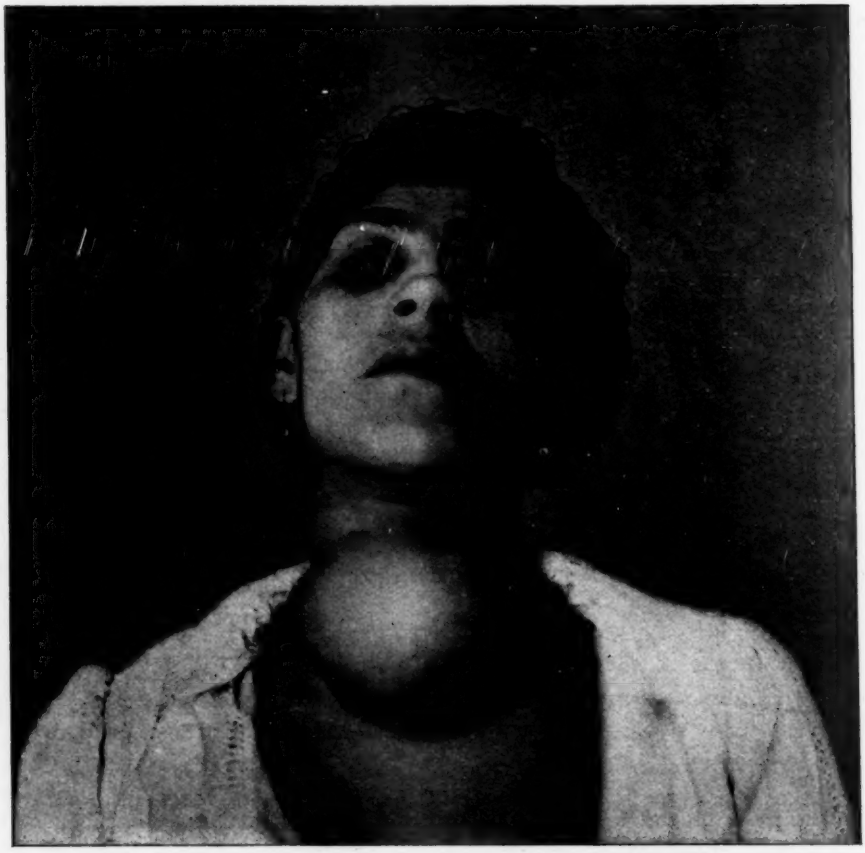

FIG. 7—Unilocular cystic goitre containing bloody serum.

be carefully selected in order to avoid the large superficial veins. As a rule the median line may be selected after a drop of Tr. Iodi. is applied at the point of entrance, Fig. 7. Sometimes the cystic goitre disappears after one injection, as in the one illustrated by Fig. 7, but as a rule it has to be repeated three or four times and, on an average, at weekly intervals. In multilocular cystic goitre (Fig. 8), the needle is best inserted at the center of the individual cyst. Sometimes they appear so hard on touch, that they leave the impression of being fibrous.

The fibrous, and especially the calcareous and osteofibrous varieties, can be demonstrated by a Roentgen plate. I had the privilege of first showing skiagraphs of the calcareous deposits in "Beitrag zur Diagnostik und Therapie der Struma, Fortschritte auf dem Gebiete der Roentgenstrahlen," Vol. IV (1900). The parenchymatous injections of a saturated solution of iodoform-ether have a marked influence sometimes in the softer fibrous type, but the shrinking process is extremely slow. Thyroid extract has an effect sometimes. The most radical measure, of course, is the removal by the knife. By combining the enucleation method with that of limited division, my mortality rate during the last five years was practically nil. (My method is described in the recent translation by Schröder, of my text-book on Surgical Diseases of the Chest, page 320, Hirschwald, Berlin.)

3. In great contrast to so-called ordinary goitre the exophthalmic form means a general infection produced by a faulty chemical activity of the thyroid gland. This being taken for granted, the natural therapy of the disease is characterized by directly attacking the thyroid gland. This is effectively done by thyroidectomy, as Kocher's admirable statistics prove. But even the great master in this field admits a mortality rate of 5%; others speak of even 30%. My previous mortality of bilateral thyroidectomy amounted to 12%, although I exercised great care, laying special stress upon hemostasis, always operating under local anesthesia (generally not even employing cocaine but resorting to Schleich's infiltration). I have, therefore, made it a rule to compromise, so to say, and to exsect the largest lobe only, thus lessening the gravity of the interference. As a rule the patient is benefited by the partial removal, as soon as the immediate effects of the operation are over. Then it remains to treat the smaller lobe which was left alone. The observation that the Roentgen method has an inflammatory influence on the walls of the blood vessels by shrinking (a specific kind of chronic endarteritis), which can be utilized in succulent tumors with therapeutic effect, induced me to try the rays in such cases of Morbus Basedowi, which

showed small enlargements of the thyroid gland with the most gratifying results. Encouraged by this, I began to apply the Roentgen method as a secondary means of therapy to the remaining lobe. Later I found that all cases of Basedow's Disease were benefited by the Roentgen method.

FIG. 8—Multilocular cystic goitre.

4. My statistics during the last five years show the following record:

Large Basedow goitre—14 cases; 13 cured by the combination treatment (also see Ueber die Kombination von Excisions- und Roentgen-Therapie bei Morbus Basedowi, Berliner klinische Wochenschrift, 1905, No. 20); one considerably improved, and one still under treatment (all women).

Thirty-eight cases, small sized goitres, most of them showing severe symptoms, especially tachycardia; 32 cases are cured, 2 improved, 1 unsuccessful, and 1 showing an increase in size and greater intensity of symptoms. This latter case seems to me to be unduly influenced by some arbitrary pseudotherapy on the part of the desperate patient. (Compare my report "Partial Thyroidectomy combined with Roentgen treatment in Basedow's disease, Post-graduate Twenty-fifth Anniversary Volume 1908.)

5. My modus operandi is: Irradiation through diaphragm in the sitting posture, usual current, for five minutes. (Fig. 9). If patient shows much uneasiness on account of the tachycardia, I allow frequent intervals. Séances every two days until there is a very slight reaction (decolorization), or if there are oppressing symptoms. Then I stop for about a week to start again until there is a considerable improvement, which will induce me to continue the treatment for 2 or 3 months, at weekly intervals. During the treatment I administer the Roncegno iron-arsenic Mineral Water in doses of a tablespoonful three times a day.

In advanced cases of Morbus Basedowi, where alarming symptoms forbid immediate operative interference, Roentgen treatment should precede the operation until improvement.

It is difficult to explain the physiological influence of the Roentgen Rays upon the Basedow goitre. The observation that the most tormenting symptoms, especially the tachycardia, often become less before the goitre diminishes visibly, indicates that first of all the toxine production in the thyroid gland is suppressed, or at least minimized. How far the sympathetic nerve system is involved at the same time cannot be answered satisfactorily at present. A large number of eminent investigators have devoted much time to these questions and some interesting facts were revealed, but nothing definite as to the etiological factors has been brought forth so far. The fundamental question will resolve itself in a metabolic problem, as many signs indicate. The cachexia strumipriva,

the Cretinism and other general symptoms of degeneration after total thyroidectomy in some individuals demonstrate that the thyroid gland has an important function, the destruction of which is apt to take its revenge. What is this function and how is it altered in Basedow's disease? On the whole it must be of a "disvirulizing" nature. Its disturbance by disthy-

FIG. 9—Lateral exposure through diaphragm of author, in a case of moderate Basedow's disease; after the twelfth exposure, as a rule the front is exposed three minutes and each side for one minute.

roidosis, over- and under-thyroidosis must therefore determine the different types of reaction.

It is most interesting also to observe the mutual relations to other organs and their various affections, and their influence on the economy of the body, as for instance in the thymus.

(See German translation of my text-book on Thoracic Surgery, page 307 and 309.) The relations to tuberculosis I have touched by presenting a tuberculous patient showing exophthalmus as well as enlargement of the thyroid, tachycardia and tremor, to the New York German Medical Society, June, 1908. (See also "How is exophthalmus, tachycardia and tremor following extirpation of the tuberculous glands of the neck to be explained?" Archives of diagnosis, October, 1908.) The elements which constitute the enlargement of thyroid tissue take an antagonistic action against tuberculous tendencies. The following observation is instructive in this respect: A girl of 25 years showed symptoms of pulmonary tuberculosis five years ago. She moved into a region in which goitre was endemic. After staying a year there she noticed an enlargement of the thyroid gland, which increased slowly. The same time the symptoms of tuberculosis became gradually less. Two years ago the patient emigrated to New York City, where I examined her about the same time at the St. Mark's Hospital. She appeared to be perfectly normal with the exception of showing a cystic goitre of the size of a man's fist. After discharging the bloody serous fluid by aspiration, I injected one-half ounce of an emulsion of iodoform-glycerin, which was followed by considerable reaction. Slight fever acerbations at evening, nightly perspiration, weakness, cough, and later the evidence of physical signs demonstrated the recurrence of tuberculous infection, which was corroborated by the microscopical examination of the sputa. The goitre treatment was given up and an antituberculous therapy substituted. At present the patient is much better and the goitre, previously reduced to one-third of its size, has become nearly as large as before. Similar observations I have repeatedly made in a region where goitre is endemic. In corroboration of the theory I may report the following family history, which embraces five generations:

(1) Man of strong appearance, when 26 years, died two years later from pulmonary tuberculosis.

(2) Son, also strong, married when 22 years old; died five years later from pulmonary consumption.

(3) Son of the former, also strong, married when 26 years old, died 14 years later from pulmonary consumption. When 36 years old he moved into a village where goitre is endemic and married his third wife, who was afflicted with a goitre of medium size.

(4) Son of the former, married when 28 years old, died when 64, the maternal mixture probably having controverted the tendency. Had 14 children, of whom 3 died as infants from intestinal and meningeal symptoms. The others are still alive, some of them being over 50.

Based on these observations, would it not be worth while trying to send tuberculous patients to mountainous resorts where goitre is endemic to let them partake of the mysterious imponderabilium which constitutes the thyrogenous element? And is it a question of bacteria or of soil or both?

X-RAY WORK IN HOSPITALS.

BY ROLLIN H. STEVENS, M. D., DETROIT, MICHIGAN.

After a few years of brilliant research by roentgenologists, the value of the roentgen ray as a necessary aid in diagnosis is being rapidly established on a firm basis. Its use as a therapeutic agent of superior value is perhaps not so well recognized by the profession as a whole, and yet its unequalled success in the treatment of certain malignant growths and diseases of the skin cannot be gainsaid.

Few hospitals in this country are now without some sort of roentgen equipment. Few hospitals, however, appear to have a fair appreciation of the importance of a first-class roentgen laboratory as a part of their equipment.

About a year ago the writer began an inquiry as to conditions in some of the principal hospitals in this country. Letters with question blanks were sent to members of this society, it being presumed that most of them were doing X-ray work in hospitals. Prompt and courteous replies were invariably received, but it was soon ascertained that many of our best known men did not find hospital work attractive.

The author desires to hereby express his sincere thanks and appreciation for the replies received.

COST OF EQUIPMENT.

The number of hospitals reporting the cost of equipment, which, it was stated in some cases, did not include old discarded apparatus, was fifty-eight. The total cost of equipment was $68,350.00 in fifty-eight hospitals. One of these, however, had spent $5,500.00 in equipment which was about twice that of the highest amount paid by any other hospital. Therefore, it was deemed fairer to leave out this hospital in striking an average. This would leave a total for fifty-seven hospitals of $62,850.00, or an average per hospital of $1,102.65.

OWNERSHIP OF EQUIPMENT.

Thirty-nine out of fifty-eight hospitals (or associated colleges), representing 67.2%, own their own equipment. In sixteen out of the fifty-eight hospitals representing 27.5%, the roentgenographers provide the equipment. In two hospitals the visiting staffs provide it, and in one case it is provided by a post-graduate college.

Sixteen roentgenologists, who represent 28% of the fifty-seven hospitals, own equipment valued at $28,000.00, which is 33% of the total cost of equipment. The average cost of apparatus furnished by the roentgenologists is $1,500.00, as against $1,025.60, the average cost of apparatus furnished by hospitals, colleges, etc.

HOW THE ROENTGENOLOGIST IS PAID.

Seven of the fifty-eight hospitals, or 12%, pay their roentgenologists salaries, and provide their own equipments. The salaries range from small and unstated amounts to $1,000.00 per year. In these cases the hospitals collect small fees from patients who are able to pay.

Fifteen, or 25.8%, of the hospitals divide all the fees with the roentgenologist, who receives no salary. The percentage the roentgenologist receives is 50% to 80%. In one of these cases the roentgenologist provides his own apparatus and plates. In one case the roentgenologist receives a stated salary and 10% of the fees. The amount of the salary was not mentioned. In five hospitals the roentgenologist receives no remuneration whatever, all except one having only free patients. In this exception the hospital is even inconsiderate enough to take all the fees from pay patients.

None of the sixteen roentgenologists owning the apparatus in the hospitals receive a salary, but depend upon the fees they receive from pay patients for their remuneration. Only one of the sixteen divides his fees with the hospital. He keeps 50%.

NUMBER OF FREE ROENTGENOGRAMS PER YEAR.

Reports on the number of free roentgenograms made per year were received from only forty-one hospitals, who make more than 45,000, or an average of about 1,097 per hospital, the number of each varying from twenty to 3,000.

Eight of the sixteen roentgenologists, who own their own apparatus, report making 1,300 free radiographs per year, an average of 162 apiece. Six of these supply their own plates and developers, seven are supplied by the hospitals, and three charge the patients a small fee to cover the cost.

AVERAGE COST OF MAINTENANCE.

Interest on cost of equipment ($1,102.63 the average in 57 hospitals) at 6%	$ 66.15
Depreciation per year, at 12%	132.31
Insurance at $1,000 valuation (what author pays)	17.70
Repairs and improvements, per year	100.00
Electricity, per year (light and power)	25.00
Tubes, per year	75.00
Cost of 2194 plates, all sizes, estimated at 35 cents	767.90
(The average of 1097 free patients per hospital per year will require perhaps twice that many plates, or 2194.)	
Cost of developers at 5c per plate	109.70
Total cost, per year	$1,293.76

This makes the average cost per plate about 59c. Where very few plates are made, of course the cost will be much higher. If but 200 plates are made a year, the cost would be about $2.10 each. These figures take no account of roentgenologist's or assistant's time, the care of the room, clean linen, etc., etc.

THE KEEPING OF RECORDS.

Only thirty-three, or 57%, of the fifty-eight hospitals keep a system of records. Seven do not report on this question, and eighteen state definitely that no records are kept. The sys-

tem varies from a book record to an elaborate card index system.

ASSISTANCE.

Only twenty-one, or 36.2%, of the fifty-eight hospitals provide assistants to the roentgenologists, and some of these do not serve continuously enough to be of much service. The trained, permanent assistant prepares the patient, gets the plates ready, develops them, keeps the records, etc., which saves much of the valuable time of the roentgenologist.

ROUTINE USE OF ROENTGEN DIAGNOSIS IN HOSPITALS.

In forty-two, or 72.4%, of the fifty-eight hospitals, roentgenographic diagnosis is a routine procedure in certain special cases, such as injuries to bones and joints, foreign bodies, vesical and renal calculi, diseases of the chest, gastro-intestinal diseases, etc. But few of them, however, make use of the ray as a diagnostic aid in all these classes, particularly the two latter. This requires the services of an experienced and skillful roentgenographer, and many hospitals will not make this field of research sufficiently attractive to secure such services.

In this connection Dr. Carl Beck says: "I am connected with several hospitals which are provided with X-ray apparatus. We use them whenever there is an indication, unconcerned whether there is any recompensation or not. Some of our well-to-do patients are willing to pay a small amount, but as a whole there is a general unwillingness to pay for X-ray examinations. The patients are far from being educated to the importance of the examination. What can you expect from them as long as our colleagues regard skiagraphy as a nice plaything, but dispute its great practical value?" In a paper in the J. A. M. A., April 18, 1908, on "Malunion of Bones," Dr. Beck remarks: "I had opportunity to observe 217 cases of malunion of bones since the early roentgen era, and strange to say most of the cases were not treated by the poor village doctor, but by surgeons of good repute, some of

them leading men. That these men would have well known how to treat these fractures in a blameless manner had they recognized their nature cannot be doubted, but they failed to make use of the roentgen ray before it was too late."

Dr. Chas. Leonard, in a letter to the author, says: "I only hope you can get at the facts, as so many hospitals underpay their roentgenologist, and make him divide his consultation fees received from private patients. They do not do this with the surgeons, although they provide them with as costly apparatus and more expensive equipment."

TREATMENT.

The roentgen ray is used therapeutically in forty, or 68.9%, of the fifty-eight hospitals. Eight of these state that they use it only occasionally. Only thirty report on the number of patients treated annually, which totals 11,000, or an average of 366 per hospital per year. Six roentgenologists receive salaries, but most of the work is free. The treatment is used in various dermatoses, epithelioma of the skin, cancer, sarcoma, leukemia, pseudoleukemia, mycosis fungoides, etc. They report on the results of their treatment in malignant diseases as follows:

In epithelioma thirty-one out of the forty report. Twenty-seven say results are "good" or "excellent." Two say they are "fair," and two say they are "unsatisfactory." In carcinoma, thirty report. Eight say results are good, twelve say results are only temporary relief, and ten say results are unsatisfactory.

In sarcoma seven claim good or fair results, ten temporary benefit, and seven "unsatisfactory."

In leukemia and pseudoleukemia, the verdict is unanimously only temporary improvement.

While great improvement has been made in the roentgen technique, it is not to be presumed that the last word has been said. Its value as a therapeutic agent is sufficiently well recognized in many cutaneous and malignant conditions, to entitle it to a place in the therapeutic armamentarium of every hospital.

CONCLUSIONS.

No hospital aiming at scientific work can afford to be without a complete roentgenological equipment. The roentgenologist is entitled to as much consideration in connection with his department as any other member of the hospital staff. The hospital should pay all expenses connected with his equipment, and the roentgenologist should be paid a salary unless he has opportunity to treat private patients who would pay him regular fees. Such fees should not be divided with the hospital.

The hospital should see that the roentgenologist has suitable quarters to work in. He requires at least two large rooms, which should be well ventilated and be kept clean and free from dust. Many roentgenologists have made martyrs of themselves to science. They can now protect themselves from some of the injurious rays by the judicious use of lead partitions. They should no longer be required to work in little, dinky, dark rooms with little ventilation. Many hours are often spent in the dark room, which at best cannot be very sanitary, but it is possible to have plenty of air space, and it should be insisted upon. There should also be ample and convenient space for the storage of plates, so that they may be properly filed away by an assistant according to a good system, and so that the hospital, and all parties concerned, may have ample protection, and the roentgenologist's valuable time be conserved when it is necessary to look up old plates.

The hospital should provide a competent assistant to the roentgenologist. It should be the duty of this assistant to get patients ready for examination and treatment, keep the X-ray room and dark room in order, develop plates, and keep the records.

X-ray work in hospitals under these conditions will be attractive to most roentgenologists, and hospital service will be greatly improved.

RIGHT LEFT

FIG. 10—Infectious arthritis of right wrist with additional centres of ossification.

INFLAMMATION AS A FACTOR IN HASTENING THE DEVELOPMENT OF OSSIFICATION CENTERS.

REPORT OF TWO CASES BY H. W. DACHTLER,

Roentgenologist to St. Vincent's and Toledo Hospitals, Toledo, Ohio.

On February 23, 1909, a girl, three years old, was referred to me by Dr. G. M. Todd, of Toledo, Ohio, for a Roentgenographic examination of the right hip joint. The clinical history was as follows:

Five months ago, the child accidentally received a wound in the side of the face from a "table fork." An abscess developed at the site of the wound which was soon followed by metastatic infection of the joints. The right wrist and left ankle joint were the first to become affected, the right shoulder joint, and one month from the time of injury, the right hip joint also became involved.

There was considerable shortening of the right leg, following the inflammation in the hip, and the patient was referred to me primarily for a Roentgenographic examination of that joint. The Roentgenograph of the right hip joint showed an "infectious arthritis" with considerable destruction of the head of the femur, and acetabulum. For purposes of comparison, I made Roentgenograms of the wrists to determine the changes, if any, which had taken place in those joints.

The Roentgenogram (Plate 10) revealed the following interesting conditions: The right wrist joint shows the destruction due to the infectious process at the lower end of the ulna and radius, and in addition a marked difference in the ossification centers when compared with the left wrist which is normal. The centers of ossification for the os magnum, unciform, and cuneiform bones normal for this age are plainly shown, and in addition to these two others, evidently the centers of ossification for the semilunar and scaphoid bones. On the plate two more points of ossification can be determined,

but on account of their situation partly behind the end of the radius, they do not show in the reproduction given herewith.

Case 2 was a girl, four years old, who was referred to me by Dr. J. H. Jacobson, of Toledo, April 15, 1908, for a Roentgenographic examination of the right ankle joint.

The clinical history was: that one year previously the child began to limp and complain of pain in the right ankle, since which time the ankle has remained inflamed and swollen. The condition had been treated for some time by immobilization and rest upon the assumption that it was a tuberculous infection. On account of a history of tuberculous infection, Roentgenograms of both ankle joints were made. A needle was found imbedded in the right ankle joint near the external malleolus, with evidences of tuberculosis of the joint. In comparing the centers of ossification for the right ankle with those of the left, the right one was found to contain one additional center for the metatarsal bones.

The additional centers of ossification found in these cases, in the presence of long standing inflammation, seem to demonstrate a definite relation between two conditions, an observation which so far as I am able to determine has never been recorded heretofore.

That these findings were normal or accidental can be ruled out for the following reasons: First, a comparison with the healthy opposite joint in each instance revealed the additional centers; secondly, that the ossification was in advance of that which is usual for children of three and four years of age.

The explanation of this advanced ossification can be readily found in the increased nutrition of the parts incident to the hyperemia and congestion of the inflammation.

This observation seems to confirm the beneficial effect claimed by Bier and his followers for their treatment of chronic inflammation by hyperemia.

The therapeutic possibilities which arise from the practical application of artificially produced hyperemia for the purpose of developing bone, open up new avenues for investigation.

The routine X-ray examination of cases of chronic joint disease (tuberculous arthritis, etc.), especially in children treated by the Bier method, may prove a means of determining the effectiveness of that treatment. Rachitis, syphilis of bone, fractures, particularly old ununited fractures, and the bone cavities resulting from operations for the relief of osteomyelitis are a few of the conditions which may be benefited if the ossification and growth of bone can be influenced by active hyperemia.

237 Michigan.

SOME INFLUENCES OF TEMPERATURE IN PHOTOGRAPHY.

BY EDWARD LEAMING, M. D., NEW YORK.

Heat increases and conversely its absence retards or even inhibits chemical action. This fact should be kept in mind by the Roentgenologist in all the work he has to do with the gelatine dry plate. By disregarding it and its application he may be working at a distinct disadvantage, while a proper application of his knowledge of the effects of heat or cold will enable him to produce negatives of superior quality. The very beginning of the dry plate—the making of the emulsion—is generally accomplished by the aid of heat, leaving out of our consideration the making of emulsions by the cold ammonia process. The mixture of hard and soft gelatines is melted together, the silver and bromide salts added, and the emulsion is then boiled; this cooking produces a change that causes the resulting dry plate to be of the rapid variety; it also causes very often a coarse granular texture of the gelatine; long boiling tends to produce decomposition in gelatine. But even the slower emulsions, which are made without boiling, are put aside in a warm room to ripen, if they wish to produce fast plates from them.

We see, then, why we are advised by the text books on photography to keep the dry plates in a cool as well as dry and dimly lighted place. The gelatine dry plate is in an unstable condition. Its very process of manufacture starts up that series of changes which, if the plate be subjected to the continued action of heat in a stuffy dark room, will surely cause fog and final spoiling for photographic purposes.

We all know that dry plates do not keep.

We can use heat as an aid in our treatment of the dry plate. The atoms in the molecules of the dry plate are in motion—the action of light causes a disturbance in this motion, and if within a certain time, depending upon the intensity and length

of action of the light, we apply certain solutions having an affinity for oxygen, we will obtain a deposit in the gelatine film. If, however, we allow a long enough period of time to elapse between the exposure of the plate to light and its development, we will get no deposit in the film due to the light action; the disturbance originally set up has had time to subside. This will be most evident in brief exposures to feeble light. Now it is this brief exposure and feeble light action that we have to consider when we attempt instantaneous radiographs.

We fail to get good images; the plates are under exposed.

We find by experiment that dry heat applied to the plate before exposure will cause an accelerated action of the atoms, but that this action will not last long; in other words, heat increases the activity but shortens the duration of the light action. This only obtains when we expose the plate while hot. If we wait after heating until the plate cools again before exposing, we get no perceptible effect other than the original effect of the exposure to light. If, then, we wish to obtain the maximum effect with very brief exposures, we heat the plate protected from light, place it while warm in the desired position for our picture and make our quick exposure. We now allow the plate to cool, when upon development we will find that we have a much better exposed plate than we could get with the same exposure on an unheated plate. X-rays are produced by electrical energy, heat, light and electricity are various manifestations of the same force, or vibratory energy. The photographic action of the X-rays is in every way similar to the action of light rays.

We all know that plates frill and melt in hot weather in the dark room unless some special precautions are taken, and even then we may have trouble. A warm developer will act much quicker and with more energy than a cold one and for that reason is better for quick exposures. But for the same reason, it is apt to cause or bring out fog on the negatives, and the danger line where the film slides off the glass support into the tray is quickly reached. On the other hand cold solu-

tions retard development and with some developers such as hydroquinone, the developing action entirely stops around 40°F. Experience teaches that development proceeds best when the developing solution is kept from 60° to 65°F., and at such temperatures the gelatine does not soften and dissolve; but we may still have that trouble known as frilling. The causes of frilling are several, and we may not prevent it by adopting any one method of procedure, but this much we know—that an almost certain method of causing the plates to frill in warm weather is to have our different baths and the washing water at widely differing temperatures. When we keep all our solutions and the wash water at the same temperature we are less liable to have trouble from frilling. Of course we can resort to alum, but that is another story. The modern method of development, called the factorial method, and the uses of the exposure meter in photography all depend upon the temperature of the developer being within a certain limit of a prearranged standard. If this be not maintained all calculations are thrown out and the elaborate tables and exposure meters rendered valueless.

Finally, those of us who have made valuable lantern slides from our pet negatives, or who keep all their records in the form of lantern slides to save space and weight, are in constant danger of having their best results spoiled by the heat of the projection lantern. Each lantern should of course have a water bath for the protection of the slides, but few do have such an arrangement. Now were the slides absolutely dry when in the lantern all would be well, for the length of time any slide is thrown upon the screen would not normally be enough to do harm. But gelatine is hygroscopic, the air is full of moisture and slides are seldom varnished.

11 East 48th St., New York City.

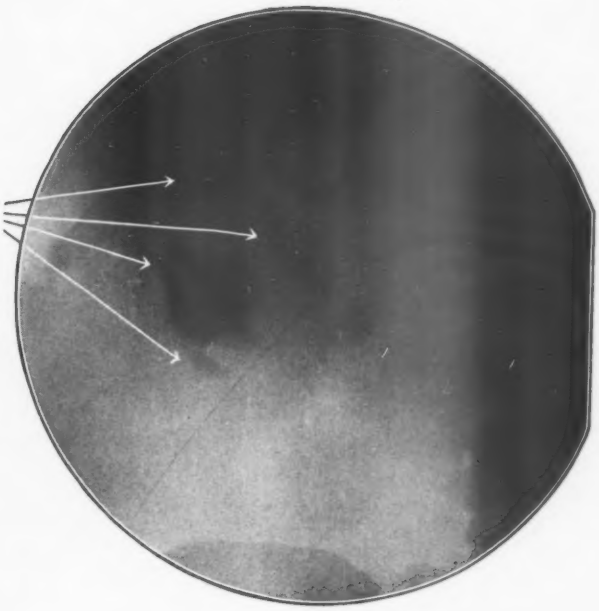

Fig. 11

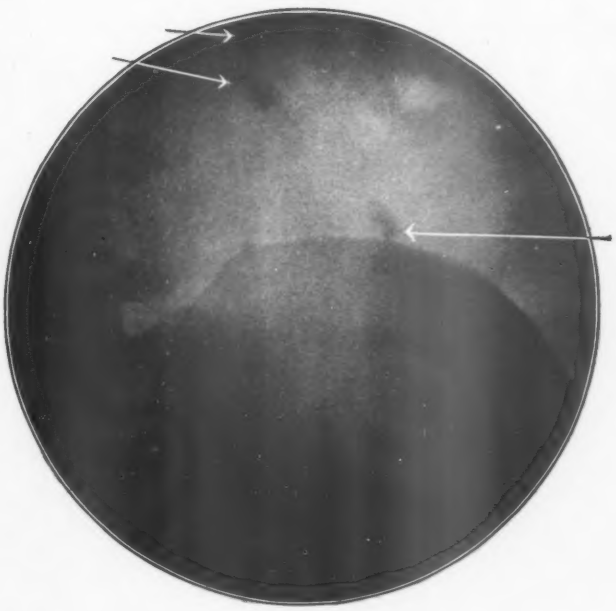

Fig. 12

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Plates 11, 12, 13, and 14 contributed by Lewis G. Cole, M. D., New York.

Plates 11 and 12 of a man about forty years old, of whom an examination was made to eliminate the possibility of renal calculus rather than to confirm clinical diagnosis. Plate 11 is of the left kidney, and in the original plate the outline of the kidney is distinctly shown, and indicates an enlarged left kidney, containing one large and four small calculi. On the opposite or right side, as shown in plate 12, are three well defined shadows; two of them are near the tip of the transverse process of the third lumbar vertebra, which is a trifle to the outer side of the normal course of the ureter. The third is the smaller of the three shadows, and is just above the crest of the ilium, and is much further from the median line, and two inches from the normal course of the ureter. All of these shadows are of about equal density. In the report to the attending physician and operating surgeon, the writer made a diagnosis of five calculi, on the left side, and stated that the shadows on the right side were not in the kidney or ureter. An operation, however, was performed on both sides, and on the left side five calculi were found as shown in the radiograph, and on the right side a thorough examination of the kidney and ureter did not reveal any evidence of the calcareous bodies that were shown in the plate. The writer's reason for making a negative diagnosis of calculi on the right side where these three distinct shadows were present, is the fact that all three of these can not possibly be in the ureter. The lower of these calculi is too far down to be in the kidney, unless the kidney is extremely prolapsed, and too far out to be in the ureter. The axis of the other two shadows is not parallel with the course of the ureter, and the density of the larger of these three shadows is not uniform, giving the mottled appearance of a calcified gland, the stroma of which is not as completely calcified as the follicle.

Plate 13. This case, Mrs. B——, about forty years of age, complained of typical symptoms of renal colic, with a moderate amount of pus in the urine. Several radiographs of the region of the right kidney were made, and they all showed a

shadow opposite the tip of the transverse process of the third lumbar vertebra but further out than the normal course of the ureter in this region. The clinical diagnosis of renal calculus was confirmed by the radiographic findings, but on operation no calculus was found in the kidney, but a calculus the size and shape of the one shown in the accompanying plate was present in the gall-bladder. Unfortunately, a plate was not made after the operation and removal of the calculus to show whether or not this shadow still existed. This case is not published to demonstrate the possibility of showing certain kinds of gall stones, but to demonstrate how readily a gall stone of sufficient density may be mistaken for a renal calculus on the right side. The blurred appearance of the edges of the stone is the only thing that would make one suspicious that it was nearer the anterior than the posterior surface, and had a radiograph been made with the plate anteriorally, it would undoubtedly have given a much clearer defined shadow.

Plate 14. This roentgenogram was from a woman about twenty-eight years old, who had typical attacks of renal colic. A ureteral catheterization with a waxed tipped catheter had revealed evidence of a calculus on the left side. Radiographs were made by another radiologist, extending from the first vertebra to the pubis and no calculus was shown. Subsequent ureteral catheterization allowed free passage of a wax tipped catheter, with no obstruction to the catheter, and without scratching the wax tip. Although the patient was prepared for a nephrotomy, the operation was postponed on account of no calculus being shown in the X-ray, or by ureteral catheterization. The symptoms continued, and a series of radiographs were made, all showing the calculus very distinctly, near the lower end of the left ureter. This diagnosis was subsequently verified by operation. I am unable to state why this calculus was not shown in the previous radiographs, but this case demonstrates that it is possible for a waxed tipped catheter to be passed by a calculus in the lumen of the ureter without giving any obstruction, and without giving a scratch on the wax tip.

Fig. 13

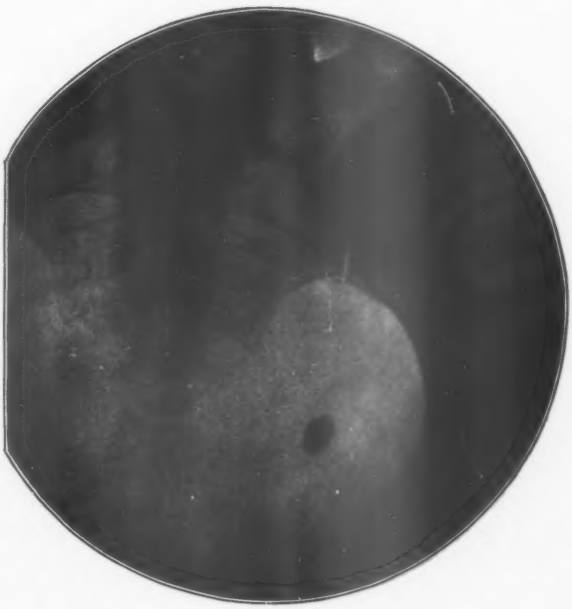

Fig 14

SPEED MANIA.

BY LEWIS G. COLE, M. D., NEW YORK.

Considering the events of the present day it is little wonder that the Roentgenologist has become infected with speed mania. It was stated in an editorial that the keynote of the last X-Ray Congress was speed in radiography. The first thing one X-ray man says to another is "how fast can you do it," and a man's standing in the eyes of his colleagues depends on how fast he can make a radiograph instead of how much detail he can show. It is doubtful if any one was more anxious than the writer to diminish the time from minutes to seconds, and we all realize the necessity of making radiographs while the patient can hold his breath.

But it is time for us to ask ourselves if we are not trying to overdo the matter of speed. We realize that absolute absence of motion is essential to good detail, and within certain limits the shorter the exposure the less likely the patient is to move, and in chest and abdominal radiography the time should not exceed the time the patient can hold his breath.

The advantages of extremely rapid exposure are that the patient is less likely to move voluntarily, and especially in children this is valuable, and there is less involuntary motion which is of especial value in stomach radiographs.

Since the last meeting the writer has compared carefully radiographs made in extremely short time with a transformer with those of longer exposure, both with the transformer and coil, and where the question of voluntary motion is eliminated the results were eminently more satisfactory where the apparatus and tube were not pushed to their extreme limit. The disadvantages of extremely short exposures are as follows:

The destruction of the tubes.—It is a sad fact well known to all of us that comparatively few tubes are satisfactory, or perhaps I should say that occasionally we get a tube that is, or becomes from use far superior to the ordinary ones, and that

with such a tube all our best work is done. With the extreme output of a four K. W. apparatus the writer was able to make a satisfactory negative of a kidney region in three seconds and of a chest in about 3/5 of a second with an old thoroughly seasoned pet tube, but unfortunately those old pet tubes only lasted for three or four such exposures, and the detail in such plates was not as good as could be obtained by a much longer exposure. The practice required by such short exposures of arranging the tube rheostat and switches so that the entire output of the apparatus was jammed through the tube all at once, lead to many failures, because one did not have time to see what the tube was doing, and the current was frequently far in excess of what the tube would stand. The results were many failures, the destruction of old seasoned tubes and joy to the manufacturers.

I then tried relatively long exposures from ten to fifteen seconds for kidneys, and from three to five seconds for lungs, using very much less energy through the tube, and the results were very gratifying. I was able to turn on the switch and advance the rheostat gradually and see when the tube began to become excited and gradually increase the current until I could judge from the appearance of the tube that it would be unwise to use more, and in this way the destruction of the tubes was reduced to a minimum and it was seldom that there was a failure. Occasionally, apparently by a fine adjustment of the amount of current to the vacuum, exceptionally good negatives would result, but the time on these would be relatively long.

The claim of those who favor rapid exposures in chest radiography is that it shows the heart at rest. Considering the fact that the heart beats more than sixty per minute, or one complete cycle in a second, it would go through an entire systole or diastole in one-half a second, it would require one-fourth of a second at least to show the heart at rest, and the speaker even with the entire output of a 4 K. W. apparatus with a seasoned tube could not make a thoroughly exposed negative in less than half a second. Therefore even theoretic-

ally the heart is not at rest for a sufficient time to show it in a radiograph. Many radiographs of three or four seconds show the outline of the heart as distinctly as any I have seen of shorter exposure.

I would therefore suggest that the keynote of this meeting be not speed in radiography but detail.

DISCUSSION.

DR. P. M. HICKEY, DETROIT, MICHIGAN.

We must also keep in mind that a radiogram is a record of density, because by doing so we can discuss these matters more clearly. We should also remember that the first records on plates which were made in this country of the human face required a direct exposure in the sunlight for several hours, and it was felt that a very wonderful feat had been performed. Compare things as they were then with what they are today. If, then, the roentgenogram is a record of density, if the part moves while this record is being made, it is at the expense of accuracy in the roentgenogram. So that from a purely theoretical standpoint speed mania in roentgenography is the thing to be sought. I remember what one of our members said some years ago, when we were discussing the claim of a certain manufacturer. He said that if his machine could make a hip in one or two minutes, he would wire an order at once. That will recall to our minds the changes that are made year after year.

Another point that occurred to me in the discussion of this paper which is really an adjunct to speed is the use of a rapid plate. If we use a plate with an emulsion which is rapid, and which will give us a record, well and good. If we use an emulsion which is so rapid that the resulting record is not clearly depicted, we are hurting our work. Personally, I do not feel that we will ever obtain the speed in roentgenography that we really require. Stop and think how much a chest moves as the result of cardiac impulse and the pulsation of

the vessels. Pass a bronchoscope and watch the movements, and you will want to make your plates in a very much shorter time than you do now. This question of how fast we should take plates is a mere matter of detail. We dislike to have anyone ask us how fast we made a certain photograph, because that is a mere matter of technic.

I agree with Dr. Cole that we should endeavor to produce the very best roentgenogram possible. When a photographer sets out to photograph a house, an ordinary horse, he usually does not take the picture with the same speed as he takes a race horse. We must study the different conditions, just as the photographer does. I agree with Dr. Cole as to the taking of two roentgenograms, for instance, of a hip. If a hip is properly immobilized, it does away with much of the necessity for speed, and that is true of other parts of the body. In that connection I have been very much impressed, and unfavorably so, with the carelessness of various men in different parts of the country. A few days ago I saw a man make a picture of a child's hip. The child was only four years old, and the roentgenographer simply told the child to keep still. The exposure lasted a few seconds, and during that time the child moved its foot several times. I have no doubt that there was considerable blurring on that plate.

With regard to the smashing of tubes, that is simply a minor detail. We must encourage the manufacturers to produce a better tube than we have now, and yet the tubes of today are very much better than were those of five years ago. Take a tube that was made five years ago, and pass through it the current we use today, and see what will happen. It should be our desire, as it is that of the manufacturer, to produce a tube that will stand up under the current we send through it today, but if a tube goes to pieces now and then, we must not be discouraged, because better tubes are being made every day.

DR. GEORGE E. PFAHLER, PHILADELPHIA.

I feel that I cannot add very much to this subject. Although the title of Dr. Cole's paper might lead one to believe that he

is not a speed maniac, I think he does not differ from any of the rest of us in that respect. Our first object must be to keep the parts still in order to get a clear picture on the plate, and if you are going to photograph the moving parts of the body, such as the diaphragm, lungs, intestines, stomach, you will have to do it in a period of time that is shorter than the time required for the organ to move. The arms, legs and joints of the body can be immobilized and we need not worry about speed. We can make an exposure lasting five minutes or ten minutes or as long as may be necessary; but the difference between one second and twenty seconds is immaterial when we photograph these parts of the body. When we photograph the lungs, we must do so while the patient holds the breath; that is, we must shorten the time of exposure considerably. If we are going to photograph the peristaltic wave in the stomach, we must do it in a second, because not more than twenty seconds are required for the wave to start at the body of the stomach and end at the pyloric end. In the majority of cases we do not require that wave to be shown in sharp detail; a blur is sometimes sufficient, so that is not a very serious disadvantage. When we see the blur, we know that the wave has passed. When it is recorded as a single identation, we do not get a great deal more information. After all, motion is best studied fluoroscopically.

I agree with Dr. Cole that the first object is to get detail in our plates. It does not matter how much time is consumed in getting that detail, so long as we get the detail. I judge a man's work by the detail he gets without paying any attention whatever to the time consumed in getting it. We must have good detail to get a good pathologic picture. Some parts of the body must be photographed in a minute, others in a second or even a fraction of a second, but we must get good results. The only advantage that I can see in using speed for all work is to bring up your technic so that you can do good work in those parts of the body where speed is necessary.

DR. EUGENE W. CALDWELL, NEW YORK CITY.

In 1898 or 1899 I read an article entitled "Instantaneous Radiography," so that I fear I must be placed in the speed mania class. However, there is not very much difference of opinion because we are all agreed that we must have good plates and that very many radiographs cannot be made with a long exposure. As Dr. Pfahler pointed out, it is necessary, even important, in many cases to have speed, and in order to do that we must develop a technic that will enable us to work fast in those cases where speed is essential. On the other hand, there are many interesting things about the speed question. I am convinced that when we get a satisfactory appliance for producing a current for the excitation of X-ray tubes, the speed problem will to a great extent disappear, and with it many of the troubles of the tube manufacturer. The appliances we have to use now are practically either the coil and transformer or the static machine, and it is my firm belief that neither of these has yet been brought to anything more than a crude stage of development. When we can get a device for exciting tubes, a high tube, with one hundred milliamperes, we can get all the speed that we need for any sort of work. So far as I know, there is no such appliance available at present.

The coil, which I believe is as fast, if not faster than any other appliance made, sends through a tube a very strong current for a very short time. When the milliampere meter reads twenty milliamperes, the tube is receiving in a short space of time a current of something like five hundred milliamperes, and I believe that I can show that I have passed one thousand milliamperes through a tube for a short time, although it is that which spoils the tubes of which we think so much. If we had a device that would pass the same quantity of current through a tube over a longer period of time, we could get better results and save our tubes. The reason the coil does not do it is because it is idle during about ninety per cent. of the time that it is in action, and I believe it is nearer 98 than 90 per cent. Through the tube there goes a flash of a very strong

current measured in hundreds of milliamperes, and then no current at all until you get another interruption.

The transformer, it seems to me, has some advantages in this respect, together with certain disadvantages. It has been demonstrated that the wave currents are longer when they emanate from the static machine than when they come from the coil. It follows from this that the wave is flatter, and that the maximum current at no time reaches so great a point as with the coil, consequently you are not straining the tube to the same extent. With the static machine you get a continuous current, and that is the ideal current, but we all know that the static machine is very far from being an ideal machine, although within the past few years some very extraordinary machines have been built, machines which I think compare in speed with the coils and the transformer. Some day we will have a device which probably will be electro-magnetic, which will give us the sort of current we need to make these short exposures without straining our tubes.

As to the necessity for short exposures, I think we must all agree that they are what we must have, although some of us have not appreciated sufficiently what can be done with a short exposure. Anyone who has worked in a dispensary to which come children of all ages, speaking all languages, or no language, will realize how useless it is to tell a four-year-old child to hold his breath or to keep still, especially when the child does not understand what you are saying. Then, most of us have had the experience of trying to radiograph the hip-joint of a child that showed its appreciation of the society of the roentgenologist by indulging in long and continued sobbing. That is a case where speed is necessary. If you watch a child sobbing, you will see that there is a point where his respirations become long, as when he gasps for breath, and there is an instant when it holds pretty still. That is the time to make that hip, but it cannot be done in minutes, nor in twenty seconds.

Even in the case of adults, the thorax cases especially, the patient is troubled with embarrassed respira-

tion, so that he cannot hold the breath as long as a normal individual. I have made experiments on myself, and once, while lying down, and with proper respiration beforehand, I was able to go without breathing for over two minutes. I find, however, that the average individual sent in for an examination of the lungs is very likely to have a perceptible movement of the diaphragm in five seconds, and I have seen evidence of movement of the diaphragm and lung in exposures of one second. If we could make an exposure of a lung in one-hundredth of a second, it would be about right. And I think it is coming. Dessauer claims to have done it already, but he admits that the best of his plates were only a little under-exposed.

This is a subject which lends itself to unlimited discussion, but I agree with nearly everything Dr. Cole has said, except the desirability of keeping at it until we do get that speed.

DR. VERNON J. WILLEY, ROCHESTER, MINNESOTA.

I am glad the discussion has established that we do not get detail by speed. We have been told times without number by different men who worked with high speed that if we want to get detail we must make the plate in the shortest possible time. Of course, we have to sacrifice something if we expect to get good plates of parts that are likely to be in motion or that are in cyclic motion. At the present time we use for that purpose high currents, high tubes and plates coated with rapid emulsions. Personally, I have never been able to get as good negatives with a rapid emulsion plate as when using one that was coated with a little slower emulsion. Nor have I gotten the detail on a plate from a hard tube that I can get with a medium tube or one that is lower than Walter 6. Nor do I think that we can get as good detail with the heaviest possible currents, as we can get with a weaker current or more rapid interruptions. To secure the greatest detail we must wait and work toward the development of a generator, such as Dr. Caldwell suggested. When we have a generator that gives a very constant potential and a constant current, then we shall have a volume of rays that instead of beginning at about

Walter 1 or 2 and climbing to 8, then dropping back so that there is neither constancy of penetration of rays nor constancy of current, when we get such a generator and such conditions, we shall be able to do successful rapid radiography without sacrificing detail or tube. It is imperative to have considerable speed in producing radiographic plates where immobility is not possible, but this is confined for the most part at the present time to the radiography of the heart, lungs and abdominal organs.

I was particularly pleased when I thought of how I had produced my best plates by relatively slow exposures when Dr. Hickey was advocating rapid exposures, and I have watched him when he produced his best plates to see how exceedingly conservative he was in carrying out the rapid exposure. Some of the men who have advocated speed, and who tell us how quickly they make a chest plate, do not always do as they say. I have seen them produce the most beautiful thoracic plates with exposures of from half a second to three and five seconds, instead of in one-tenth or one-twenty-fifth of a second. I have attempted to produce such rapid plates, but all I succeeded in doing was to spoil some of my best tubes. There is no doubt but the instantaneous exposure is one of the greatest things to be accomplished, one of the things we desire most strongly, but we must not sacrifice detail or beauty of plate, because it is perfection of detail on which we base our diagnosis. That is what we are more concerned with than in anything else, and when we succeed in making rapid exposures without sacrifices, it is a point gained, but it seems to me that in radiography of the extremities or joints we can get better plates by making a little bit slower exposure, using a little bit softer tube, and not trying to send too heavy a current through the tube.

DR. M. K. KASSABIAN, PHILADELPHIA.

I often have to radiograph insane patients and children who do not understand what you say to them, or they get excited, so that I make it a rule to give them a hypodermic of mor-

phine before they come to the X-ray room. That quiets the person, but whether that can be done in private practice, I do not know. I have very few things in the room the patient enters, because when he sees big machines, tubes and apparatus of all kinds, he is frightened. For children I use very soft tubes, so that they will not spark too much and scare them. Then, too, children can be given a little chloroform without being harmed in any way. I have often done this in my private practice. Then, again, I take time to show the patient the spark, so that he will get used to it, and after a little while you can make a very good plate without any trouble whatever.

DR. CALDWELL.

What Dr. Kassabian said about the ether or chloroform brings to my mind the case of a negro child, eighteen months old, which was chloroformed on my table. The doctor who administered the anesthetic left before the child woke up, but I stayed there four hours trying to bring the child out from under the anesthesia. It is also well to inquire whether the child has congenital syphilis before you give it any chloroform.

DR. D. R. BOWEN, TROY, N. Y.

I am very much interested in this question. Any of us can hear of an unexpected death from chloroform, the death occurring after the first three or four or five whiffs, the death which renders you absolutely helpless, and you cannot do anything for the patient. It is not necessary to use chloroform; you can use ether just as well, and get the same results that you do from chloroform. It is needless to have a secondary stage of excitement, and these people do not die. I have known of a child, four years old, dying under chloroform anesthesia given for the purpose of placing three or four stitches in the case of an incised wound. I do not think that chloroform anesthesia is necessary to get a good radiogram. On the other hand, we can always give a hypodermic of morphine, and many of these patients, who are suffering pain, get needed relief in this way.

DR. PERCY BROWN, BOSTON.

In Boston it is almost heresy to breathe the word chloroform because Boston is the birthplace of ether, and all operations are performed under ether. I think, however, that far better results can be obtained by personal persuasion, if the child is of a reasoning age, or by attracting the attention of the child by some other means, because the administration of ether produces the same respiratory effect as when children sob. I think anesthesia, whether chloroform or ether, is something to be avoided, if possible. Of course, there are cases where it does not make much difference, but it seems to me that anesthesia is inferior to the more psychological method of producing quiet.

DR. CHARLES LESTER LEONARD, PHILADELPHIA.

You will recall that it is not very many years ago when you heard me talking about making calculus plates in eight or ten minutes, when the rest of you were making them in five minutes. In the exhibit you will find some pictures I made, showing the heart standing still, and you can believe me when I say that these pictures were made in one-fourth of a second. Some stomach plates I have were made in one second exposure. I can also tell you that you will not get the peristalsis of the small intestine with a one second exposure. The change of speed as I have found it lies in the fact that you get detail of the soft structures, of the hard structures, of the whole picture. Look at the plates, and you will see the structure of the spinal column with the patient lying on the abdomen. I do not believe that you can get that in a time exposure.

With reference to tubes: All the plates I have on exhibit were made with the same tube, one which I have used for two years. I have not smashed a tube by making fast exposures, although I have punctured one. The walls of the tube got so black that the rays would not penetrate it. I had that tube repaired. The anode has a hole in it, but the tube still makes sharp pictures with a short exposure. I began my work at the

time with a new machine to see how fast I could use it, and I have used it that way ever since. The value of it is not alone in the ability to produce detail, by cutting out motion of the heart in thoracic plates, or cutting out the intestinal peristaltic waves in abdominal plates, but also in getting tissue detail no matter what part of the body is skiagraphed. Use your plate and tube with the idea of getting the best contrast, no matter what sort of plate you are making, whether of bones, of lungs, or abdominal organs. Get detail. I showed a hydrostatic condition of the hip joint so that you can see the distended capsule of the joint, the fluid in it, the ligaments about the joint and the muscles of the thigh. But that detail goes with speed. You will find that proven more and more definitely. It does not depend on whether the vacuum is high or low. You want to make your plates so that you can make a diagnosis from them. The plate must always be made with the idea of looking for the pathologic lesion which you expect to find or exclude.

Quite recently I had a subject which required the longest exposure I have ever given with the tube I mentioned. It was a twenty seconds exposure. The man was center rush on a football team for two years, and it was like getting contrast out of bone rather than out of muscle. The point I wish to make particularly is that speed is of value in producing detail. That the adaptation of the quality of light in the tube gives you more or less penetration, dependent on the vacuum, and that both high and low vacuum, with speed, give the desired detail.

DR. GEORGE C. JOHNSTON, PITTSBURG.

So far as I can see, the only reason for speed in radiography is to secure immobility of a part during examination. If immobility can be obtained by mechanical means, then speed is unnecessary, even undesirable. The first requisite of a successful skiagram is that it shall show the structures in such manner as to permit of differentiation of all anatomic struc-

tures through which the ray has passed or as many of them as it is possible to show.

The principal fault we all observe when we watch other men work is in their attempts to obtain immobility. I did X-ray work for quite a number of years before I had any conception of what that meant. I learned my first lesson in that work from Dr. Cole, and I thought he was a perfect old woman in the way he went about to get a good picture. I thought it was absolutely unnecessary to do all the things he did, and yet I realize that his pictures were superior to anything I was getting out. The great secret of it all was that he was a crank on the subject of immobility. Then it occurred to me that there might be something in it. I made pictures of children, and I often wished that they had more bone salts in their bones when the matter was the children were moving. Then the lesson was driven home by a series of skiagrams made by Dr. Cole from the cadaver. That was the solution of the whole problem. I saw that to make such pictures as he made there must be absolute immobility of all the tissues and since then I have done considerable work along that line and I now have things so arranged that I can keep my patient quite still.

I use sandbags and compressors of all kinds. I never let the patients eat anything before they come to me. These examinations are always made in the morning. Even in sinus work immobility is essential. It is ridiculous to attempt to make a picture when the chin moves with every heart beat. I have a device for holding that chin absolutely still. I ask the patient to move the head, and if he can, I screw up my device until movement is no longer possible. In making a lateral view I also use compression, putting the plate against a solid block, so that compression can be made safely, and I surround the head with sandbags so that it cannot move. In that way you will get a good picture. You can use the kind of tube you want, you can use the energy that that tube can efficiently transform, you get away from the inverse discharge and all secondary rays and you can use the plate with an emulsion so slow that the grain can be made fine enough so that the plate

does not fog. The slow iso plates with extremely fine emulsion are the best.

For the last two years I have used in every exposure plates not larger than 10 by 12, two plates, face to face, one a slow emulsion, the other a fast emulsion. In every case, without exception, where the exposure was correct the slow plate was infinitely the superior of the two.

Ultimately, of course, the question of speed is bound to come up in stomach work. It is absolutely necessary, as we all know. In the location of foreign bodies in the lung, where removal with the bronchoscope is necessary, with the patient suffering more or less from dyspnea, there is much difficulty to be met in making a picture. A short exposure is necessary, and detail must be sacrificed to some extent.

When a child is to be examined, and it absolutely refuses to hold still, I have a professional anesthetist give nitrous oxide and oxygen, so that I never anticipate any trouble. Only enough is given to quiet the child. The inhaler is removed quickly, for fifty or sixty seconds there is absolutely no motion, and that is sufficient time in which to get a good picture. Neither is there any nausea or vomiting following the anesthesia, as is the case when chloroform is given. Anyway, I never allow anyone to give chloroform in my office.

Where the larynx is to be examined, speed is, of course, essential, and the same thing is true in other instances, but the making of extremely rapid exposures for the determination of spinal troubles or hip troubles is to my mind an absolute fallacy. I find that better detail can be secured with a slow exposure. Moreover, it takes the X-ray tube some time to get into action. I allow a few minutes for the tube to get into action. The current is invariably turned on with the rheostat, and turned off with it, except where rapid exposures are to be made. When making pictures of children whom you do not want to anesthetize, I find it a good plan to talk to the child and make a couple of time exposures. When the child is too young to understand me, or when it cannot speak English, I

blow a very shrill whistle with considerable force. The noise petrifies the child long enough so that I can make a very good exposure. That scheme has helped me out very many times.

DR. COLE (closing).

I am delighted to get out of this without being criticized worse than I have. I believe you realize that the object of my paper was to elicit discussion. In the paper I mentioned the necessity and advantage of the short exposures where motion could not be done away with entirely. I think that the standpoint of speed changes. Sometimes we go to the limit of speed. They have come to the limit of speed in photography. We should use a slow exposure where we can, and only use the fast exposure when we must.

Dr. Willey expressed my views for me much better than I did in my paper. He brought out all the facts that I intended to mention and made all the points I intended to make. The fact that speed is not the only essential for detail is the point I want to maintain. Making extremely rapid plates is not the only essential nor the prime essential to getting the best detail in a plate. I do not believe that we should sacrifice detail for speed, as some of us are perhaps inclined to do.

In response to Dr. Caldwell's remarks, I would not for a moment discourage anything which would increase the efficiency of apparatus to do a thing in the one-hundredth or one-thousandth part of a second. I am sure none of you will believe that I am advocating being satisfied with what we have, either in technic or in results, and I do hope that Dr. Caldwell will succeed in producing the ideal generator which will give us the necessary detail with the shortest possible exposure.

In regard to Dr. Leonard's discussion, I am not quite sure whether he intended to make the statement that speed was alone the essential, or the prime essential, in obtaining detail. If that is so, I must take exception to it. It is an important factor and a necessary factor where there is motion, but the

mere fact of being able to produce a plate in a very short period of time will not guarantee that you have the detail which you can get with a long exposure.

In regard to the detail which Dr. Leonard spoke of, in the case of fluid in the hip joints, with an old tube, a portable apparatus, and the patient in bed, I was fortunate enough to obtain one plate out of six that showed the capsule distended as distinctly as anything I could desire. It was one of the few freak plates I have made, and it makes me ambitious to show the detail that we all know it is possible to obtain on certain occasions. The exposure, under the most unfavorable circumstances, was from fifteen to thirty seconds. It was not the speed, however, which gave me the detail in that plate.

Dr. Johnston said that one of the principal indications for speed is when we want to show a foreign body in the lung. I had a patient who inhaled two tacks. They were both on the same side. My assistant made the plate and although it was somewhat blurred, the tacks showed very distinctly. They were extracted. About two weeks ago the patient came back to the office complaining that she had the same whistling in her throat as before, and naturally she thought she had some more tacks in her lung. I made a plate and found one tack in the right lung and another in the left lung. At the suggestion of Dr. Johnston, I radiographed the abdomen and found any quantity of tacks there. Here were two tacks well out in each bronchus, one on the left side, the other on the right side, showing in the radiograph made in from seven to eight seconds, and the points of the tacks were as fine and clean-cut as though the tacks had been set on a table with the plate behind them. Dr. Hickey may see the movements of the lung bronchoscopically, but he saw the shadow of these tacks because they were not moving.

I feel reasonably sure that we are not very far apart in this matter, and I am willing to concede that it is necessary to make short exposures of moving parts, but the one thing on which we do not agree is that speed is the primarily essential point in obtaining detail.

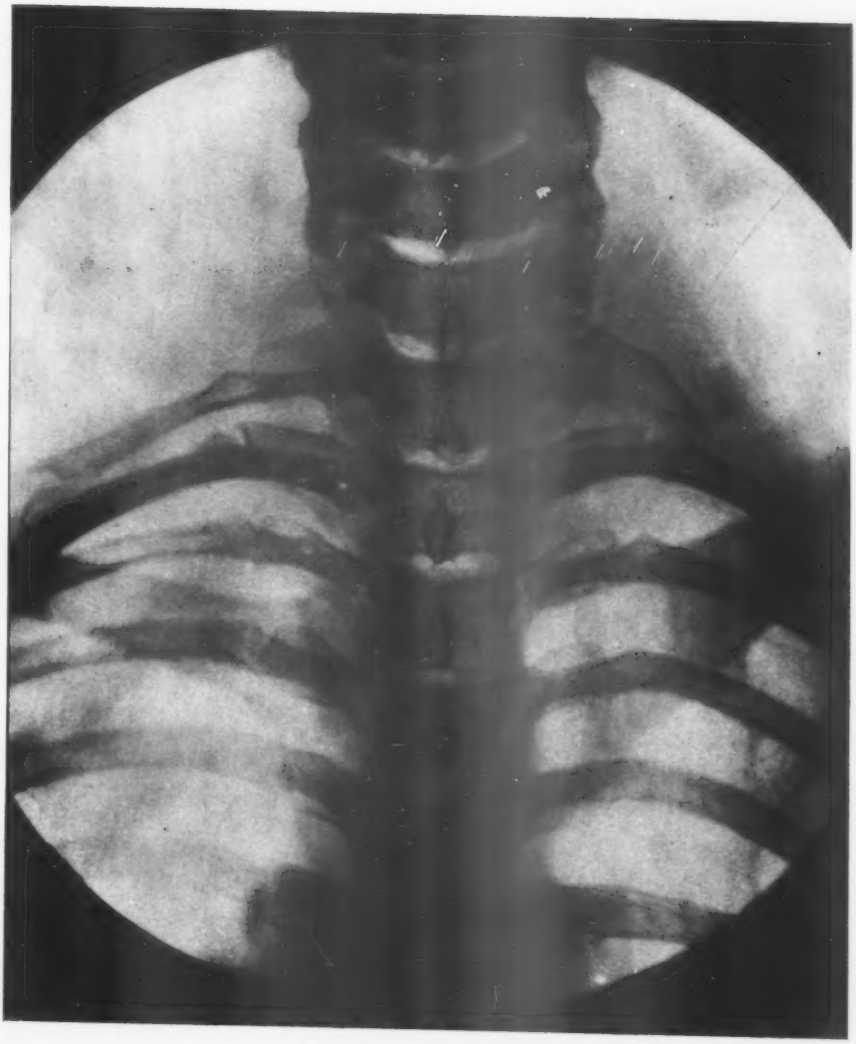

FIG. 15—Bilateral cervical ribs.
Negative by Dr. R. D. Carman, St. Louis.

ROENTGENOLOGICAL BERLIN.

BY EDWARD HOLMAN SKINNER, M. D., OF KANSAS CITY.

The first impression of the roentgen work in Berlin is that of the wide and general use of the roentgen ray in all departments of medicine and surgery for both diagnostic and therapeutic purposes. It is extremely satisfactory to note the careful and attentive use of the x-ray in the internal medical clinics as a check or means of corroborating the clinical examination. They consider that a heart, lung or abdominal diagnosis is not complete without the roentgen examination. This examination not only supplements and substantiates the clinical history but also furnishes an exact means of recording the "projected pathological" picture. From the standpoint of the clinician visiting Berlin, the use and value of the roentgen ray is eminently satisfactory. From the standpoint of the observing roentgenologist, there is still an apparent lack of protection. This carelessness, however, portends no harm to other than the operator and his assistants. But when one stops to consider that up to the present time, over 150 have been victims of the continued action of the roentgen ray in Germany, and some 25 in England, and over 12 in America, then should the director of every roentgen installation take every precaution possible.

Suffice it to say, that one who has spent only two months in Berlin should not take the liberty of stating positive conclusions on the roentgen work of Berlin. One can only relate impressions and beg the indulgence of his readers and those referred to, for any errors. It is needless to add that this is all written in the attitude of a friendly observer and not as a scientific criticism.

The foreigner entering Berlin would naturally first look up the roentgenologists whose names have been associated with this department of medicine since its inception. Among these appear the names of Levy-Dorn, Immelman, Grunmach,

Davidsohn, Cohn, Schmidt, Kronmayer. If I have overlooked other important names, I have the honor to ask the pardon of such men and shall attribute my failure to my limited, though perhaps inexcusable, knowledge of German roentgenologists.

At this point it may be opportune to relate the manner in which the roentgenologists work in conjunction with hospitals and clinics.

At some of the large hospitals, such as Rudolph Virchow Krankenhaus, Moabit Krankenhaus and others, there is but the one large and comprehensive roentgen installation. This is in charge of a leading roentgenologist, who spends probably two hours of the day regularly at the hospital where he organizes and supervises the work and makes the interpretations and reports of the negatives of the previous day. For these services he receives a salary of an extremely modest sum. Attached to the laboratory there may be a permanent assistant or an interne of the hospital. There is always a large number of sisters or orderlies attached to the department, who become quite capable and valuable.

At other hospitals of lesser capacity than the above, one frequently finds a sister in charge, who makes exposures for both diagnostic and therapeutic purposes at the order of the attending physicians. While I have frequently found good negatives at such hospitals, it is nevertheless quite apparent that the work lacks woefully in scientific exactness and there is a carelessness regarding protection of workers and patients. This can easily be attributed to the lack of roentgen knowledge and supervision.

Then there is a third division of roentgen installations. In one hospital, The Charite, there are several installations; one being in conjunction with each of the large Polikliniks for Internal medicine, Surgery, Orthopaedics, Ear, Nose and Throat, etc.

At these installations is found one of the Privat-Docents or assistants in charge, with capable helpers. Here is found the most extensive use of the roentgen ray and its scientific and practical adaptation to the various specialties. It is quite pleasing to see every heart case presented at Prof. Kraus'

clinic with an orthodiagram of the thorax. While these installations may lack in roentgen technique, they may be excused for this, in that they are doing such magnificent missionary work in showing the necessity of the adoption of the roentgen ray as an exact method of diagnosis in medicine and surgery.

From this general consideration, let us pass to the description of individual hospital installations. The first that comes to mind is naturally the largest and most modern: that at the new Rudolph Virchow Krankenhaus under the direction of Prof. Dr. Levy-Dorn. The roentgen-institut occupies a separate three story building of pleasing exterior and well designed interior arrangements. The ground-floor consists of three roentgen rooms; one each for surgical exposures, fluoroscopy and a treatment room. On this floor there is also an office, waiting rooms for men and women, and a dark room. The second floor is given over to a photographic and light therapy department. And the third floor contains ample room for viewing and storing negatives and records. Dr. Levy-Dorn has both the Hoch-Spannung and Induction apparatus for roentgen exposures and uses a Grisson-Condensator apparatus for fluoroscopic work. The roentgen institute at Rudolph Virchow shows at the first glance that it was designed by a master mind in roentgen technique and no expense has been spared in making this a model installation.

The roentgen installation at Moabit Krankenhaus is located in the operating pavilion. Dr. Max Cohn is the director of this most practical institute. One sees a most satisfactory technique for abdominal diagnosis at Moabit. There is a very apparent atmosphere of improvement in exact technique and apparatus under Dr. Cohn's direction. And it is truly gratifying to note that the Bismuth meal according to the formula of Dr. Cohn is relished by the patients and also furnishes excellent shadows for the fluoroscopic screen and the negative.

Several of the installations at the Charite present interesting observations. That under the Klinik for Internal Medicine of Geh. Rat. Prof. Kraus and in charge of Privat-Docent von Bergman is in constant use for heart and lung diagnosis and

also for lesions of the alimentary tract. Prof. Kraus is favorably inclined to the extensive use of the roentgen ray in internal medicine and the roentgen diagnoses presented in his clinic are an ample proof of the correctness of his advanced stand.

The installation in the Ear, Nose and Throat clinic in charge of Dr. Oertel is extremely neat, simple and exact. Dr. Oertel favors the use of the sitting position for head negatives, stating that in this position there is less blood in the vessels of the head and consequently less confusing opacities upon the roentgen negative. He has devised a clever head and body fixing apparatus and recommends a medium hard tube for good sinus definition.

There are several private installations, which for many clever devices and special arrangements would warrant description. But the limited space forces the writer to forego the pleasure of complimenting them individually, as I do here now, collectively, praise them.

The keen competition of the manufacturers in Berlin is one reason for the variety and completeness exhibited in the various hospitals of Berlin. On the other hand, one must not lose sight of the fact that the profession of Berlin has probably come to the point where they demand good roentgen installations, as this method of diagnosis leads to exactness and finality in the examination of the patient. If the physical signs and the chemical analysis and the roentgen examination coincide, there can be no possible doubt. And if they do not coincide there is always some good and demonstrable reason for this fault, that can usually be cleared up by improving the hearing or the eyesight of the clinician; by a thorough testing of reagents and cleansing of test-tubes by the chemist, or by the increased knowledge of the value and correct interpretation of fluoroscopic or radiographic shadows by the roentgenologist.

Permit me in closing to express my appreciation of the cordial reception afforded me by the Berlin roentgenologists whom it was my pleasure and privilege to meet in their own laboratories.

Berlin, November 25, 1909.

EDITORIAL.

Message From the President.

To the Members of the American Roentgen Ray Society:

Prepare now for the next annual meeting to be held at the Cadillac Hotel, in Detroit, Sept. 29th, 30th, and Oct. 1st.

Send the title of your paper to the president or to Dr. Henry K. Pancoast (Chairman of the Executive Committee), Philadelphia, Pa. The program is being made up now and a number of important papers are already listed.

Use the regular application blank in securing one *good* new member. It must be signed by two members in good standing. The applicant can only be elected at the annual meeting. The dues are $10.00, payable after election, but by the payment of $5.00, one can obtain the Quarterly for the year.

Write up one or two of your most interesting cases, with a brief description of the roentgenographic findings. Use about one hundred words for each case. This will be published in the proceedings, and, if of sufficient importance, the Roentgenograph will also be published. Bring the lantern slides of the cases with you, demonstrate them and give the history and the description. If possible bring the original plate or a copy, and place it in the "plate exhibit" for further study by the members. This is to be a feature of the program and every member is expected to take part. *Send your name to Dr. P. M. Hickey,* Detroit, and state whether you will have one or two cases, so that sufficient time can be allowed on the program for each member.

Select six of your most interesting lantern slides, therapeutic or roentgenographic, to be used in a "Lantern Slide Demonstration" at another hour. These are not to be put in the proceedings, but will surely broaden the views of every man present. These two exhibits alone will make it worth your while to attend the meetings.

Yours very sincerely,

GEORGE E. PFAHLER,

1321 Spruce Street,

Philadelphia, Pa.

The flattering reception which was accorded the first issue of the Quarterly, encourages the Editor to go on with the work, and endeavor to conscientiously promote the interests of the Society.

We are very sorry that illness caused delay in the getting out of the first and second numbers of our publication. However we anticipate that the third number of the Quarterly will be published in two months, so that all the papers which were read at the last meeting of the Society, and such additional matter as may be deemed wise to publish will be in the hands of the readers long before the annual meeting.

The Fifth International Congress of Medical Electrology and Radiology will be held at Barcelona, Spain, from the thirteenth to the eighteenth of September, 1910. For further information inquiries can be directed to Dr. Chas. Lester Leonard, 112 South 20th St., Philadelphia, Pa.

We are very glad to announce that arrangements have been made with Dr. Bowen, Rome, New York, to publish in coming numbers of the Quarterly an index of articles which appear in American Medical Literature on the subject of Roentgenology.

Dr. Bowen has long been interested in devising such an index, and the Editor is very glad to co-operate with him in bringing before the members of the Society this valuable work. Dr. Bowen, while not attempting to abstract the articles, will add such comments as may lend additional interest more than the mere title of the paper would convey.

This index, it would seem, is destined to be of great value in bringing before the members of our Society, what is being done by American Roentgenologists. Its production necessarily entails a vast amount of work, and as members we are under deep obligation to Dr. Bowen for taking up this new work.

Dr. Rollin Stevens, of Detroit, who is busy with the preparations for the coming annual meeting in that city, assures us that the work is progressing favorably, and that everything points to good accommodations for members and exhibitors and to a large and successful meeting. We are glad to publish

a letter from the President, to which special attention is called, inasmuch as valuable suggestions are made for promoting the interest of that meeting.

A feature of the recent meeting at Atlantic City was the interest shown in stereoscopic radiography, and we are glad to announce the publication in the coming number of the Quarterly of a well illustrated article on this subject.

In talking with a recent graduate of an institution, not many miles from our national capital, we noticed the appearance of the hands of the youthful practitioner. The fingers appeared atrophied, and the skin manifested the dryness and roughness so characteristic of an old Roentgen dermatitis.

In conversation with the young man, we learned that he was required by the medical authorities of the Hospital where he served his interneship, to hold the children while they were being rayed. The apparatus in use was an old fashioned static machine, and the exposures covered comparatively a long length of time.

While he was in the institution his hands were the seat of a chronic dermatitis, and we judge that he will never fully recover from its effects.

The requirement on the part of hospital authorities to subject their internes to the continued influence of the ray, is something which should be taken up, and should be absolutely prohibited even if legislation is necessary. The medical authorities of any Hospital certainly have no right to demand of those doing the work in such institutions such sacrifices to their health.

We are glad to think, however, that such requirements are due to the ignorance of the medical men rather than to any intention to subject their assistants to danger.

REVIEWS

FORTSCHRITTE AUF DEM GEBIETE DER ROENTGENSTRAHLEN, BD. XIV, H III.

The Anatomic Basis of the So-called Hilus Shadow on the Roentgenogram, by Eug. Fraenkel and Alex Lorey.

By means of a series of experiments upon the lungs of cadavers and still-born infants the authors demonstrate that the stellate markings at the lung hilus and the radiating markings which extend from the hilus to the periphery of the lung are due not to the bronchial tree but to the pulmonary blood vessels.

The most convincing experiment was upon the lung of a still-born infant. A skiagram of the atelectatic lungs gave a shadow of uniform density showing no structure; a small quantity of air was blown into the bronchi, but not enough to inflate the lungs fully. A skiagram at this stage revealed the outlines of the inflated bronchial tree but not in **white** shadows but in **dark** markings, i. e., the air filled bronchi were more transparent than the surrounding lung tissue. The lung was then completely inflated and upon the resulting negative the **dark** markings of the bronchial tree had disappeared (blotted out by the surrounding air-filled alveoli) and instead new markings appeared which were not dark but light, i. e., of greater density than the rest of the lung. When blood was injected into the pulmonary artery these markings became very prominent, proving them to be produced by the pulmonary blood vessels. The authors therefore urge the adoption of the term "vessel shadows" instead of "bronchial shadows."

Severe Nervous and Psychic Disturbances following Roentgen Burns, by Prof. Dr. Paul Krause.

Krause reports two cases in which severe nervous symptoms and (in one case) severe psychic symptoms followed an X-ray burn. In neither case was there symptomatic evidence of any

organic change in the nervous system and the causal relation of the nervous disturbances to the X-ray burn is not proven. They would probably be classed as traumatic neuroses.

Calcinosis Interstitialis—A New Disease, by Prof. Dr. Paul Krause and Dr. Max Trappe.

This is a second report upon a case which was first described in Vol. XII of the Fortschritte by the same authors as an early stage of Myositis Ossificans Progressiva. But the subsequent history, particularly the regression of the process and the improvement of the symptoms has led the authors to advance the term calcinosis interstitialis progressiva et regressiva for the condition.

The case was that of patient who since 1901 has suffered a stiffening of his musculature especially around hips, knees and arms. The calcification was easily palpated and was demonstrated upon the skiagram. But the ossifying process differs from the well-recognized condition known as myositis ossificans progressiva in the following respects:

(1) The process began in arms and legs. In myositis ossificans the trunk is first affected.

(2) Micro-dactylic, which is so characteristic of myositis ossificans is wanting in this case.

(3) The skin is adherent to the bony masses beneath and seems thickened. Not found in myositis ossificans.

(4) From the skiagram it is apparent that the ossification has taken place in the subcutaneous connective tissue and in the intermuscular fascia, but not in the muscles themselves.

(5) Improvement in the symptoms and partial disappearance of the bony deposit as revealed by subsequent skiagrams indicates retrogression of the process, which never occurs in myositis ossificans.

Ulcus Ventriculi—Diagnosed upon the Skiagram, by Dr. F. Reiche.

A remarkable skiagram is here presented. From the lesser curvature of a greatly dilated stomach there appears a small

projection, pedunculated like a mushroom. The patient presented symptoms of gastric ulcer and died of hemorrhage and a terminal thrombosis of the right jugular vein.

The autopsy elucidated the skiagram. In the lesser curvature there appeared an ulcer about the size of a quarter, which during life, had been evaginated like a glove finger due to high intra-gastric pressure, giving rise to the peculiar projection seen on the X-ray.

A Case of Outward Dislocation of the Astragalus, by Dr. Franz Winkler.

A brief report with skiagrams and favorable outcome.

Failure of Both Lung Apices to Light up Simultaneously, by Dr. A. Bittorf.

The author noticed in making fluoroscopic examinations that the healthy apex becomes visible upon the screen before the diseased one. He refers to the difference in the time required for the two apices to become distinct on the screen and he considers it easier to note this difference in the cases of slight apical involvement than it is to determine an actual difference in density in the very early cases where such increase in density must be very slight. This time difference is best brought out by beginning with a weak light and gradually increasing the current.

Cosmetic Improvement of Roentgen Cicatrices by Fibrolysin Injection and the Quartz Lamp, by Dr. P. F. Becker.

The author obtained a very favorable result in a case of X-ray scar following radiation for lupus by giving 20 injections of fibrolysin and treatments with the Kromayer Quartz lamp, 10 minutes duration, distance 10 c.m., without filter.

Control Scale for the Correct Choice of Tube and Time of Exposure, by Carl Beez.

A small penetrometer is placed upon the plate during exposure which records the penetration of the tube upon the

negative. If the plate is unsatisfactory the cause can be determined by noting the control scale and remedied on the next exposure.

HEFT IV.

Action of X-rays upon the Testicles, by Prof. Dr. M. Simmonds.

The author carried out an exhaustive series of experiments in guinea-pigs and mice.

The practical results of this study are well summed up in the following conclusions:

(1) After sufficient exposure of the testicles, the spermatogenic cells are destroyed but the sustenacular cells, the spermatozoa, the interstitial tissue and the blood vessels are unaffected.

(2) The disturbance in the cells develops only after the lapse of a variable length of time after the exposure (21 days was the shortest time for the appearance of changes in the testicle. Even where the dose was so heavy as to kill the animal in less than three weeks, no changes in the testicle were found).

(3) The first change consists in the cessation of spermatogenesis.

(4) The effect of the exposures is not always parallel to the length of the same. In some animals a twenty minute exposure produced changes which in another 200 minute dose failed to do.

(5) If the animal survives the exposures, a regeneration always occurs and normal spermatogenesis is again established. No matter how severe the exposure there can usually be found some intact spermatogenic cells and these may give rise to the regeneration process.

(6) Parallel with the destruction of the spermatogenic cells there is an over-growth of the interstitial cells and vice versa, as regeneration proceeds, this over-growth again recedes.

(7) The changes produced by the X-ray are not similar to those found in "interstitial orchitis."

(8) In those animals in which the testicles were injured an increase of adipose tissue was later noted.

(9) Changes in the testicles can be produced by very short exposures with heavy milliamperage. With a tube-skin distance of 1½ c. m., slight changes were noted after a three second exposure.

(10) Secondary rays, even after acting for months, do not affect the testicles. Three guinea pigs were exposed for six months to secondary rays at a distance of four feet from the tube without showing any effect on the testicle.

Roentgen Findings in the Skulls of Epileptics, by Prof. Dr. E. Redlich and Dr. A. Schuller.

Skulls of 100 epileptics from Prof. Wagner's clinic were examined by Dr. Holzknecht. The following positive results were obtained:

The first eleven cases were traumatic in origin.

Cases 1, 2, 3 and 4 showed upon the skiagram bone defects in the skull of varying size.

Case 6 showed a splinter of bone 5 mm. long projecting from the inner table, the result of a previous trauma.

Case 7 showed an area of thinning over left temple, while case 8 showed a thickening of the right parietal bone. In two other cases foreign bodies (a bullet and a needle) were found.

Cases of epilepsy with cranial asymmetry and deformity are next reported, including "turm-schadel," microcephalie, pseudo-microcephalie, hydrocephalus; asymmetry of the skull associated with paralyses and epilepsy was shown in one case. Hyperostoses and syphilitic ostitis were found in several cases. An old calcified area of encephalitis and two uncalcified brain tumors are among the cases reported. The one tumor was recognized by its destruction of the sphenoid bone while the other produced areas of absorption of the cranial vault.

The authors conclude with the statement, that every case of epilepsy should be examined by X-rays. While in many no additional information will be gained, yet in others a more accurate conception of the case as well as therapeutic and operative indications may be thus discovered.

Instantaneous X-ray Exposures, by Frederick Dessauer.

Dessauer presents a method of making Roentgenograms in 1/10 to 1/100 of second with an X-ray coil. A single interruption is utilized to flash the tube just for an instant. The primary amperage is not over 50. The coil must be one of great capacity and especially constructed for such work. The method of obtaining the single interruption of the current is similar in principle to a cartridge fuse. The fuse wire is encased in moist clay and when the current is turned on it becomes hot and fuses and at the same time generates steam in the clay, so that a sort of explosion occurs which breaks the current absolutely sharp. It is this "opening-spark" which generates a secondary current of over 200 milliamperes just for an instant. A new fuse is used for each exposure. Light and inexpensive tubes may be used, as there is very little heating. For adult hips and the heavier parts an intensifying screen is necessary. The new type of screen with fine crystals is recommended. The fuses are very cheap and the method makes immobilization of the patient unnecessary, thus saving much time.

"Der Expositionsmesser" (A scale for determining the correct time of Exposure), by Frederick Janus.

An ingenious scale is here presented for determining in a given case and with varying physical factors (tube, milliamperage, etc.) the correct time of exposure necessary to obtain a perfect roentgenogram. The instrument is based upon the following equation:

$$F = \frac{t \times i \times p}{S^2 \times d}$$

$$\text{or } t = \frac{S^2 \times d}{i \times p}$$

Where F=Energy expended upon photographic plate
t=Time of exposure
i=Milliamperage
p=Penetration of tube
s=Focus-plate distance
d=thickness of part to be skiagraphed

Tumor of Base of Brain Diagnosed by X-Ray, by Dr. Hermann Algyogi.

This report adds to the rather limited number of brain tumors diagnosed **directly,** that is where the diagnosis did not depend upon changes in the bones of the skull. The tumor being well calcified cast a heavy shadow in the region of the sella turcica and extended laterally almost to the left mastoid process. Its upper margins were distinct but irregular, below it was continuous with the sella turcica. The shadow on the lateral skiagram was 2--3 cm. high and 6 cm. long. As to the origin of the tumor the author concludes that it sprang from the infundibulum rather than from the hypophysis making the differential upon the following points which he considers characteristic of infundibular tumors.

(1) Suppression of menses.
(2) Absence of acromegaly.
(3) Extreme calcification of the tumor.
(4) Irregular spread of the growth.
(5) Age of patient (37 years).

Infundibular tumors occur mostly in younger individuals and are carcinomatous in nature arising from the lining epithelium of the canal.

Isolated Disease of the Tarsal Scaphoid as an Evidence of Disturbed Development, by Dr. Behn.

Haenisch and Kohler first described this condition in children from five to nine years of age. The etiology is obscure. The child without apparent cause complains of pain in the region of the scaphoid and favors the affected foot. Tenderness is present over the dorsum of the foot and the arch may be flat.

The skiagram shows a scaphoid which is ¼--½ the normal size. It is irregular in contour and very dense, showing no distinction between medulla and cortex and no structure whatever. The lime content is apparently doubled or tripled.

The prognosis is good. Rest and protection decreases the pain and restoration to the normal occurs in 1½ to 2½ years.

The condition has been variously attributed to juvenile osteomalacia, anomaly of development, shrinking of a normally developed bone or trauma to the cartilage previous to its ossification.

Roentgen Therapy with Short Exposures, by Dr. H. E. Schmidt.

Schmidt refers to the report of Albers-Schonberg, in the previous issue, who was able to administer the erythema-dose in 30 seconds, using 30--40 milliamperes in the secondary. Walter 6 tube and 13 cm. focus-skin distance.

Schmidt by using a special tube (Therapie-Central-Rohre) which is blown very thin opposite the target and which has the target placed close to this thin section of the glass wall obtained the erythema effect in 60 seconds. He passed only 1.8 milliamperes through the tube using a coil and a mercury interrupter, thus causing less injury to the tube. The tube was Walter 7, focus-skin distance — 12 cm. He does not advocate such short exposures however, because of the danger of slight overdose.

Isolated Fracture of the Carpal Cuneiform Bone, by Dr. Metzke.

This rare fracture resulted from a fall upon the hand which as a rule causes either a Colles' fracture or a fracture of the scaphoid. The author attributes the rarity of this fracture, first to the protected position of the cuneiform, protected by the pisiform and semi-lunar and, second, to the fact that the cuneiform has no direct connection with the radio-carpal joint.

An Improved Intensifying Screen (Gehler-Folie), by Dr. Alfred Rosler.

In order to overcome the objections of the usual intensifying screen, namely the hazy mottled effects which it produces, the author presents an improved Wolfram screen which is claimed to overcome these objections. The light is a pale violet and much more intense and clear than the screens heretofore used. It is claimed that the time of exposure may be cut down to a fraction of that employed with any given equipment. Thus, a knee which required two minutes exposure, required with this screen only two seconds. As to the life and durability of the screen nothing is known. The author has used one three months without appreciable deterioration. "Gehler-Folie" is the trade name of the screen.

A Case of Unusually Large Exostosis of Os Calcis, by Dr. Janowsky.

The report of this case emphasizes the very important fact that os calcis spurs are usually painless until a dropping of the arch causes pressure upon them. In this case the patient complained of pain in the right heel which foot also exhibited slight flatfoot. The skiagram showed a fairly large exostosis from the under surface of the os calcis. An examination of the other (left) heel showed an unusually large exostosis almost an inch long which was causing no symptoms whatever.

SIDNEY LANGE, M. D.

BOOK REVIEWS.

Through the courtesy of the J. B. Lippincott Co., we are in receipt of a volume by Dr. Thomas Morgan Rotch, entitled, Living Anatomy and Pathology, the Diagnosis of Diseases in Early Life by the Roentgen Method.

This is a large, handsome volume, very amply illustrated, most of the Roentgenograms being made by Dr. Ariel George. Dr. Percy Brown has contributed several plates on the Roentgenology of the gastro-intestinal tract in children.

This work of Dr. Rotch's takes up the anatomy and pathology of infants, from a medical and surgical standpoint, as elucidated by the Roentgen Ray. An immense amount of work has been done, and the plates which are shown are of very high order.

The reproductions have been carefully made, and form a very distinct addition to American literature in this branch. The text has been carefully prepared, and serves to well elucidate the Roentgenograms which are presented.

This volume should be in the library of every Roentgenologist, as it constitutes a valuable contribution to American Roentgenology.

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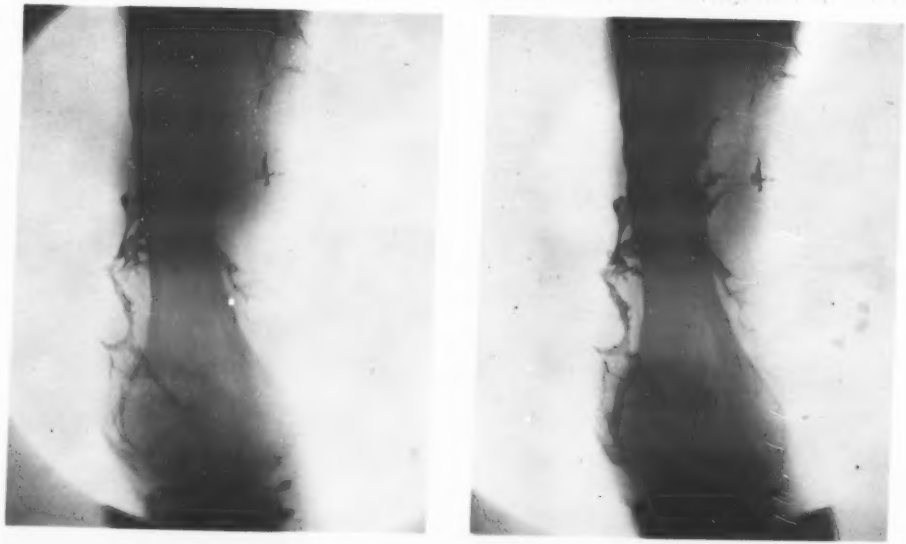

STEREO I. SINUSES INJECTED WITH BISMUTH PASTE

STEREO I. SINUSES INJECTED WITH BISMUTH PASTE

ILLUSTRATING ARTICLE OF DR EMIL G. BECK, CHICAGO

The network of the sinuses surrounding the knee joint and the femur is clearly shown in plastic effect after same had been injected with 33% bismuth vaselin paste. We can see whether the sinus is in front or behind the bone or whether it runs through it.

THE JOHN CREAN LIBRARY

STEREO I. SINUSES INJECTED WITH BISMUTH PASTE

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ILLUSTRATING ARTICLE OF DR EMIL G. BECK, CHICAGO